Top-Band Dir

by Chris Plummer G8APB

In the second part of this article the author's receiver is described with sufficient detail to enable you to build one for yourself.

The receiver was developed by Bill North G3TRY and the author and is constructed on a single printed circuit board.

The Circuit

The basic set is designed around the now elderly TAD100 integrated circuit, but the newer TAD110 can be used as a direct substitute. The oscillator, mixer, detector, and audio pre-amp. stages are in the i.c. and a separate f.e.t. r.f. amplifier and a bipolar audio amplifier and beat frequency oscillator are also provided. The TAD100 has, unfortunately for our purposes, internal a.g.c. but this can be disabled by putting a preset d.c. bias voltage on pin 1 via the mixer coil.

Looking at each of the stages separately and noting their particular features you will see that all r.f. signals enter the set via a tuned frame or ferrite rod antenna if the case screening is effective. The construction of a frame or loop is relatively simple, the size can be adjusted to suit the case chosen for the set and can form the carrying handle for the unit. Construction can be of wood bound with sticky insulation tape and the wire let into a groove, or a metal frame screen such as a trough of aluminium, with the wire inside the trough. Make sure, however, that the aluminium trough does not act as a shorting loop to the antenna or you won't hear much. The gap in the trough can be bridged with wood or a plastic material. A ferrite rod antenna is fairly simple to make by winding the coil on the centre of the rod and fitting it either in an insulating tube mount, or a metal tube with a slot (Fig. 2.3). As with the frame antenna the rod mounting can be used as the carrying handle. One thing to remember is that the bearing is taken along the axis of the coil, i.e. at right angles to a frame antenna and along the axis of a ferrite rod.

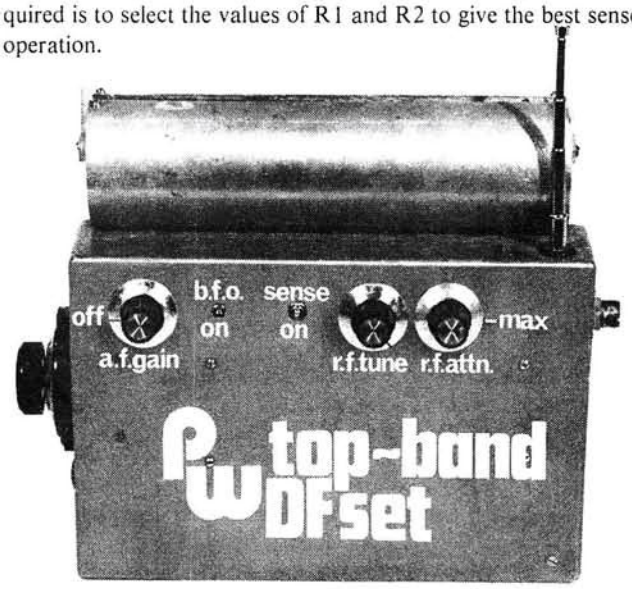
The r.f. stage is a fairly common arrangement, but here screening is important as leakage from the antenna across the r.f. stage can cause errors and confusion when close in to the transmitter. Attenuation of the incoming signal is by a variable resistor in the base of the 2N3819 f.e.t.

The TAD100 forms most of the circuitry with the exception of the tuned circuits. The oscillator is fairly standard and tends to be relatively easy to get going, the tuning range is (1·81–2·0+i.f.)MHz, i.e. 2·275–2·465MHz plus a small amount at both ends to allow for calibration. The local oscillator is deliberately set on the high side of the received signal to avoid i.f. image interference from medium wave signals.

The audio stage is self explanatory and needs no alignment. It will drive any commonly available high-impedance headphones. Headphones are used, of course, to keep your information to yourself and also help concentration, as well as being lighter, both in weight and battery consumption, than a more powerful amplifier and a loudspeaker.

The b.f.o. is a transformer feedback oscillator and only requires that the feedback winding is connected the right way round followed by a quick tune and adjustment of the injection to maintain oscillation and correct operation.

The final stage to consider is the sense amplifier. This is an untuned stage that amplifies the signal from the separate telescopic whip antenna and combines it with the signal from the main antenna at the correct level and phase relationship. This enables the operator to determine the correct direction from the main antenna, as previously described. The only adjustment required is to select the values of R1 and R2 to give the best sense operation.



BUYING GUIDE

Most of the components used are readily obtainable from advertisers in *PW*. The TAD100 can be obtained from Watford Electronics. The p.c.b. is available from the usual suppliers or from the author QTHR. Toko coils and formers can be obtained from Ambit International. A suitable "vernier slow-motion drive" is available from Maplin Electronics as RX40T vernier dial medium. Electrovalue stock Jackson variable capacitors.

Approximate Cost £34

Construction Rating INTERMEDIATE

ection Finding

Part 2

The set has been built by some 150 people either for use as a good simple Top Band receiver or as a d.f. set and very few problems have arisen. The p.c.b. design, which is a single-sided board approximately 150 × 50mm, is set out with plenty of room to use "junk box" components. Toko coil formers are recommended for the local oscillator and mixer coils, but unfortunately no prewound coils are available and to use these coil formers you need 42 s.w.g. enamelled wire or finer to be able to get all the turns required on the bobbin. It is of course possible to use other formers without problems but the turns will probably have to be adjusted. The filter is a standard Toko CFT455C, similarly the b.f.o. coil is a standard prewound unit. Three forward-biased 1N914 silicon diodes have been used to produce a reference voltage of about 1·4V as it was the cheapest way, but a 1·5 to 2V Zener could be used.

The complete receiver is built into a die-cast box. The author's prototype used a box 222 × 146 × 55mm in size. Remember that in use the receiver will probably be subjected to rain, mud, floods and other extremes of climate and temperature so make sure that there are no unnecessary holes in the case. The two-gang capacitor (C21,22) could be a Jackson C808 or other split-stator type according to price and availability.

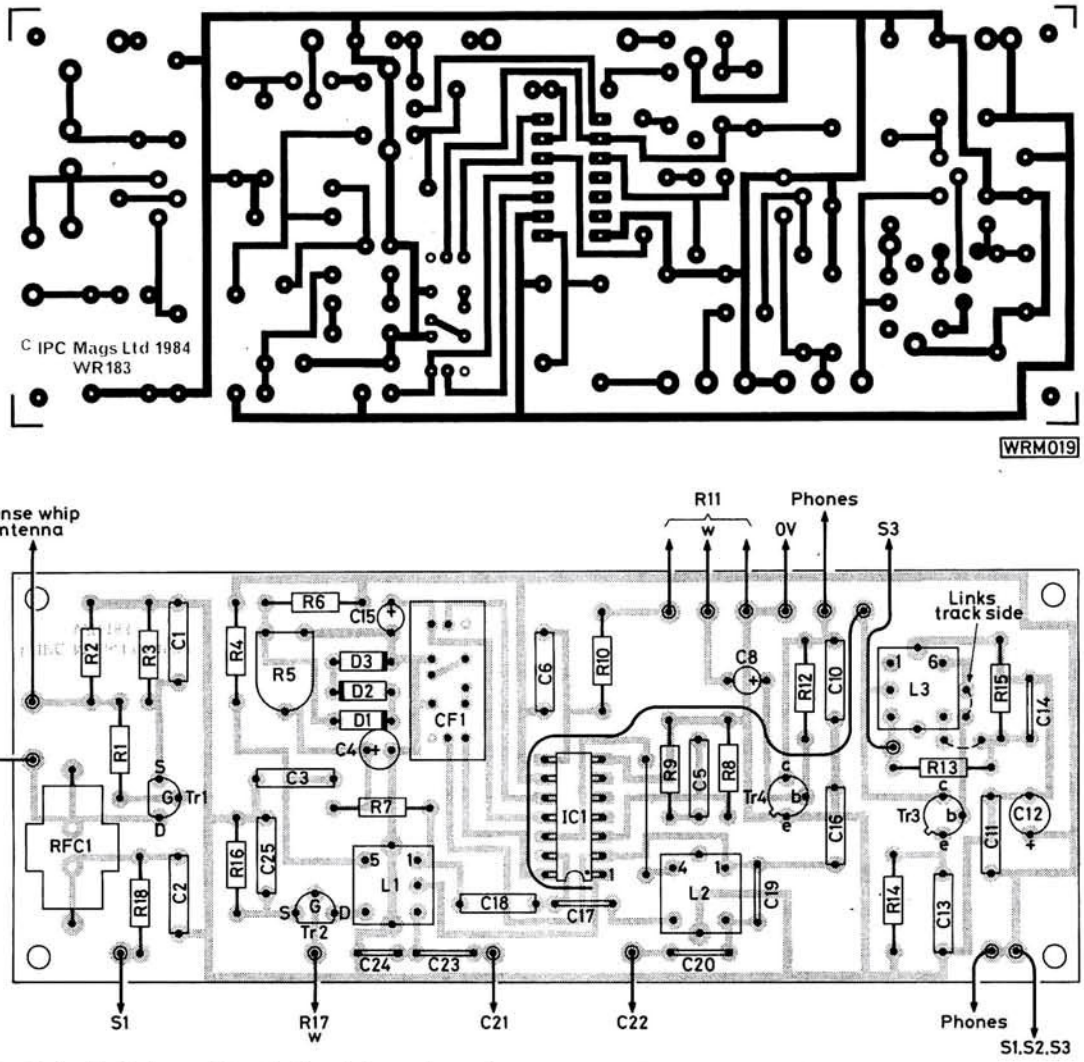
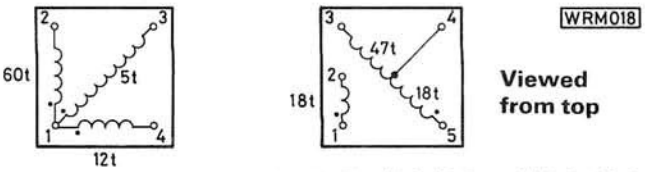
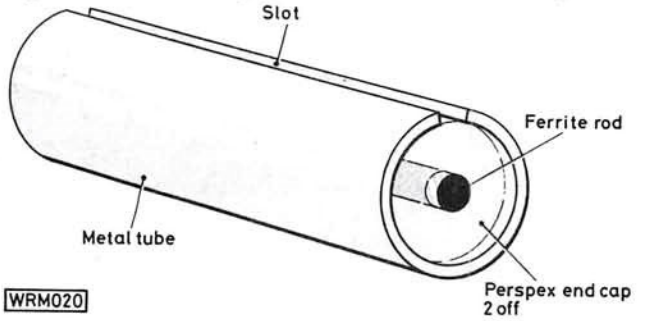


Fig. 2.1: Full size printed circuit board track pattern and component placement drawing. Note the insulated lead coupling the b.f.o. output to the general area around IC1 pin 1. Its route is not critical but care must be taken to ensure that it does not short to any other component



WRM018

Fig. 2.2: Coil winding details for (left) L2 and (right) L1



WRM020

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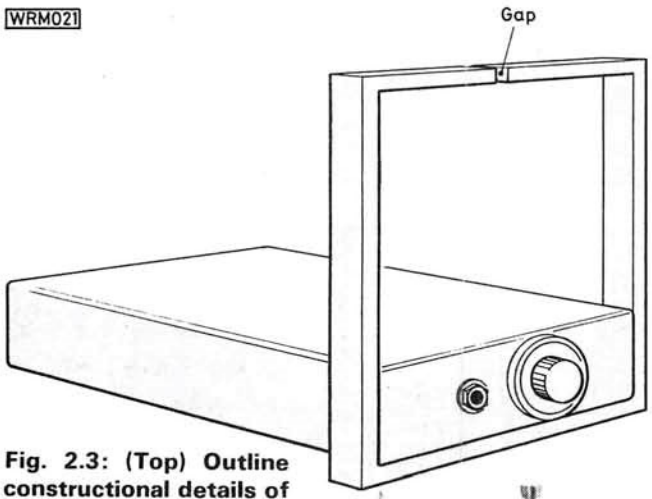


Fig. 2.3: (Top) Outline constructional details of the ferrite rod antenna. (Above) Frame antenna details

The author's much used prototype receiver showing the ferrite rod antenna and vernier tuning dial

★components

Resistors

Carbon Film ¼W 5%

150Ω	1	R18
180Ω	1	R9
220Ω	2	R4,16
470Ω	1	R10
820Ω	1	R8
1kΩ	1	R14
3·3kΩ	1	R6
4·7kΩ	1	R3
5·6kΩ	1	R7
10kΩ	1	R15
47kΩ	1	R2
68kΩ	1	R13
470kΩ	1	R12

Potentiometers

Min. Horizontal Preset

5kΩ	1	R5

Midget Carbon Track

5kΩ (Log)	1	R11 (with switch)
100kΩ (Lin)	1	R17

Capacitors

Polyester

10nF	9	C1,2,3,7,9,10,11,13,25
47nF	3	C5,6,18
100nF	1	C16

Ceramic Plate

100pF	2	C19,24
220pF	2	C20,23
1nF	1	C14
2·2nF	1	C17

Tantalum Bead

0·33µF	2	C8,15
4·7µF	1	C4

Electrolytic

22µF	1	C12

Air-spaced Variable

50pF	1	C26 (Jackson C804)
50+50pF	1	C21,22 (Jackson C808)

Semiconductors

Diodes

1N914	3	D1,2,3

Transistors

BC108	2	Tr3,4
2N3819	2	Tr1,2

Integrated Circuits

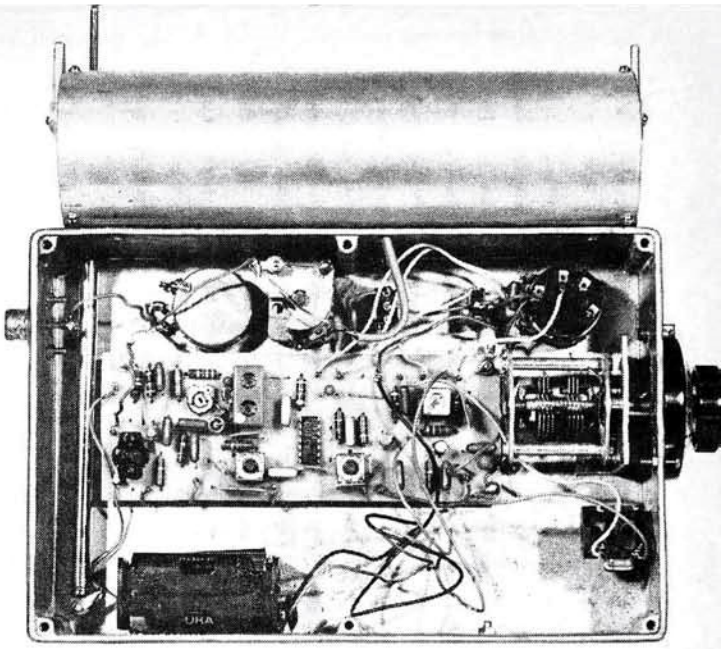
TAD100	1	IC1

Miscellaneous

Ceramic filter (CF1) Toko CFT455C; Coil (L3) Toko YRCS12374ACS; Coil formers Toko 10K (2); Min. toggle switches s.p.d.t. (2); Slow motion dial; Jack socket ¼inch; Battery holder; Diecast box; Telescopic antenna; Ferrite rod (see text); Knobs (3); Choke (RFC1) 2·5mH; Material for ferrite rod or frame antenna (see text).

Alignment Notes

1) Beat frequency injection is achieved by taking an insulated wire from the collector of the b.f.o. transistor to somewhere near the TAD100. No direct connection will be required.
2) Set the i.f. gain control preset for maximum signal.
3) Depending on the local oscillator and mixer coil windings select those capacitors marked * (Fig. 1.4) to achieve correct bandspread and tracking.
4) The main antenna frame (200 × 250mm) can be made of hardwood or metal (remembering the break if metal is used), with windings to suit tuning, say about 13 turns. A 200mm long ferrite rod 10 or 12·5mm diameter with about 25 turns wound on it mounted in a plastics or split metal tube could also be used.
5) Select resistors R1, R2, R3 and R4 to give best operation. Typical values would be R1 = 7·5kΩ, R2 = 620Ω, R3 = 220Ω, R4 = 230Ω. Use a 10kΩ preset in place of R1 for setting up. Set R1 to about 7·5kΩ and select R2 to give a drain current of about 3mA. To select R1 to give best sense operation use the following method. Set up a friend with a transmitter and travel about 5km away into open countryside. Adjust R1 to give the best sense circuit operation, i.e. greatest front to back ratio. Measure the value of the preset and replace with the nearest preferred value resistor.
6) Capacitor Cx is approximately 2pF and is made from a twisted pair of insulated wires 30mm long.
7) Set the local oscillator range on high side of 1·81–2·0MHz and then peak the mixer coil at midband.



Acknowledgements

My thanks must go to Bill North for the initial design work and trials, to Eric Mollart for the urge to write it down and Roy Powers G8CKN for being the "Devil's Advocate."

Good luck and good d.f.ing de Chris G8APB.

Further Developments

The receiver described is obviously of a specialised nature but can form the basis of a Top-Band monitor receiver and this will be described in another article. ●