Top-Band Dir

by Chris Plummer G8APB

Top-Band "d.f.ing" (direction finding) has been carried out in the UK for around 60 years, and many still regard it as a "black-art". Basically it is just a combination of skill with a radio set, map reading and a lot of luck in the ultimate game of "hide and seek". It is a pastime for the young and old alike, from seven to seventy, at a national level.

The equipment is regarded by many as highly specialised, but really its only requirements are a directional antenna, such as a ferrite rod or loop, and a screened case. The rest of the electronics could be a retuned medium-wave receiver. Most of the protagonists in local club and national events use a purpose-built set. In past years these were battery valve sets, but with the advances in technology most of the best receivers in use today use the circuitry to be described below. They can cost no more than £10–15 even if you buy a case and all new components.

The Theory

Simple trials with an ordinary medium-wave portable receiver tuned to your favourite early morning "TWIT"—sorry, T. Wogan Esq.—on Radio 2 will show up broad maximum signals broadside to the ferrite rod and deep minimums or nulls off the ends. On earlier sets with frame antennas this will be a maximum in line with the frame and a null when broadside on. This is known as the *Cos Ø* relationship.

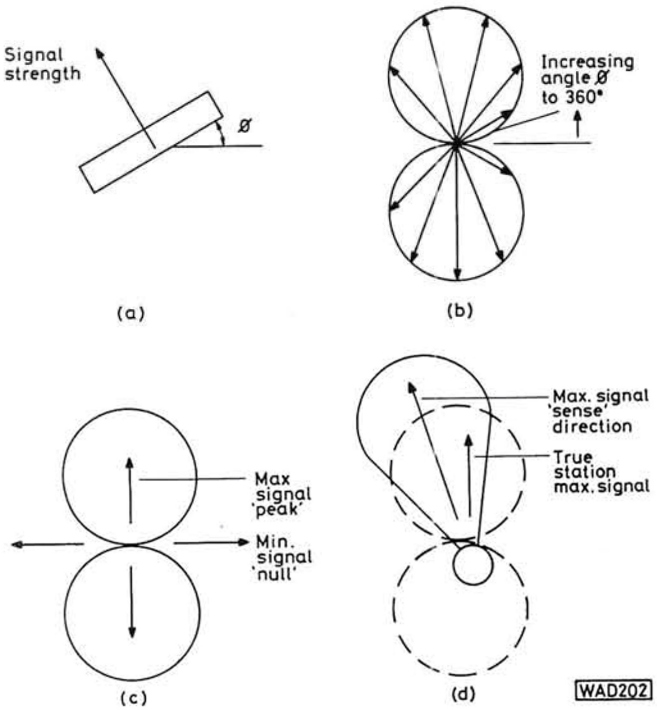

Fig. 1.1

If you plot signal strength as a function of the angle through which the set is turned from a reference point (angle Ø), the relationship is *Cosine Ø* (Fig. 1.1).

As can be seen from the double-circle pattern, Fig. 1.1(c), there are two equal, fairly broad, maximum signals, and two much narrower minimums or "nulls". Thus to get an accurate bearing on a station one or other of the "nulls" is used. This gives one of two directions, and under normal circumstances, such as sailing in the Channel, this would be sufficient as a cross-bearing would be obtained from another transmitter or from a different position some time later. However, for radio direction finding it is simpler if only one bearing or null need be found. This is done by introducing a signal from a separate whip antenna amplified to a level and phased such that it can cancel part of the pattern, producing the pattern in Fig. 1.1(d). It is then relatively easy to decide by comparison of front and back signals which is the correct direction. It is inadvisable to use solely the large maximum as a bearing as it is usually offset from the true direction of maximum signal.

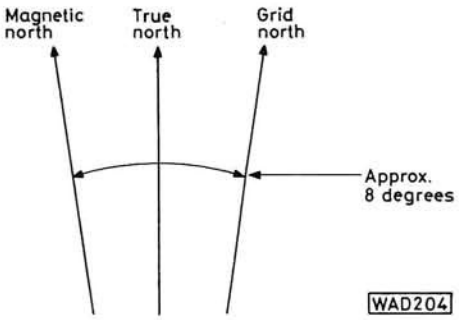

Fig. 1.2

Maps

Once a bearing is obtained, noting that a hand bearing compass is calibrated 0 to 360 degrees, i.e. 0 degrees for magnetic north, through 90 degrees for east, 180 degrees for south, 270 degrees for west etc., the bearing is plotted on a 1:50000 Ordnance Survey map of the area. Care must be taken to make allowance for the difference between the magnetic bearings of the compass and grid north on the lines on the map. This difference is normally about 8 degrees west of north.

Inspection of the edge of the map will give you the variation for that map (Fig. 1.2), but it must be noted that the correction also varies with time, about half a degree per eight year period, as the magnetic pole moves slowly, so check the "revision" date of the map.

It is in fact simpler than it sounds, particularly if you mount your compass with an 8 degree offset on the receiver or antenna, so that you actually read the compass in "Grid" degrees.

Having obtained a bearing relative to "Grid north", pinpoint your actual location on the map, align the centre of a circular protractor at your location and plot the bearing

ection Finding

Part 1

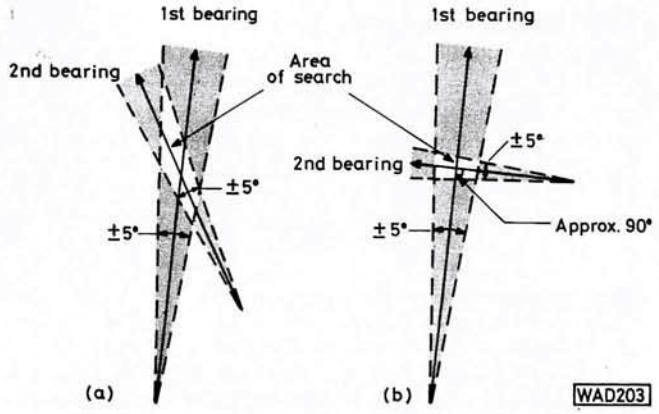

Fig. 1.3

on the map with ruler and soft pencil. It is possible, but rather fiddly, to use an overlay of "Clingfilm" with a crayon and this also keeps the map dry.

Bearings

You have now produced the first bearing, but remember that at best this is only accurate to ±5 degrees; at worst, due to various factors it is only accurate to ±25–30 degrees. You should then choose a second location for your next bearing so that this second bearing crosses the first at as near 90 degrees as possible. This can reduce the search area required, and it is a good idea where possible to reduce your distance from the hidden station so that the search area is reduced even more (Fig. 1.3).

As transmissions and time goes on, further bearings are taken, gradually closing in on the transmission source, and transport is finally abandoned. "Bush-beating" is soon

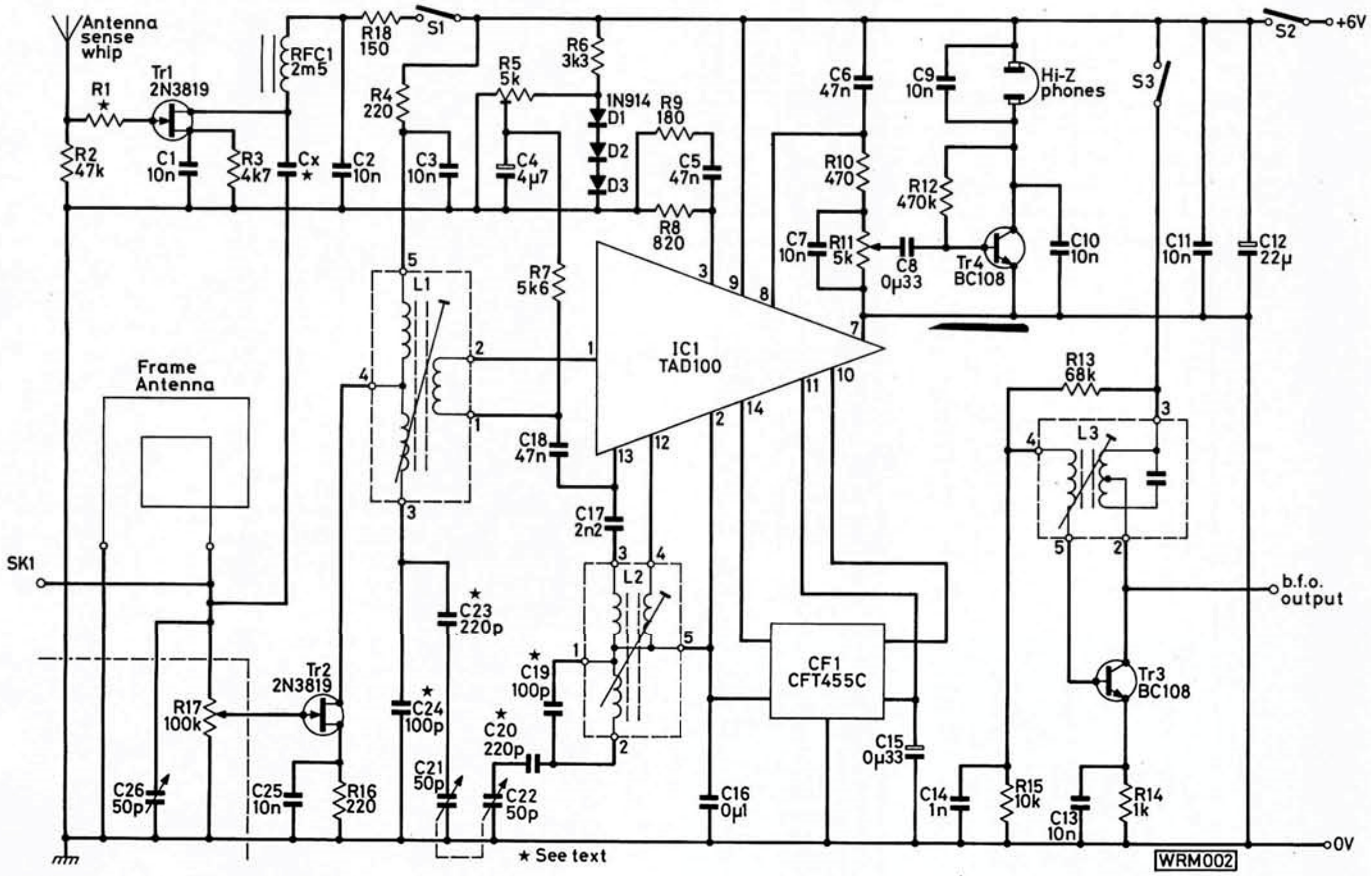

Fig. 1.4: The circuit diagram of the receiver to be described with constructional details in Part 2. The basic circuit is designed around the TAD100 i.c. This i.c. contains the oscillator, mixer, detector and audio pre-amp stages. The TAD100 has internal a.g.c. and this is disabled by a d.c. bias voltage on pin 1 applied via the mixer coil L1. Tr2 forms a j.f.e.t. r.f. amplifier while Tr1 operates as the sense amplifier. This is an untuned stage amplifying the signal from the sense whip antenna before combining it with the signal from the main antenna. Tr3 is the b.f.o. and is a conventional transformer feedback oscillator. The audio amplifier, Tr4, will drive any high-impedance headphones

taken up by the operator and helpers, i.e. look under or in anything big enough to hide the "fox". On arriving closer to the transmitter some attenuation will have to be inserted in the input of the receiver to avoid it overloading. At this time the advantages of the screened case become apparent as the only signal entering the set will be from the antennas, not through the sides of the receiver case.

After maybe many frustrating minutes or even hours you will probably find your hidden (sadistic) station. What you hope you have done is to find it or possibly them before anyone else.

Confusion

Just to confuse you, most of the organised events transmit on a random schedule of not more than 15 minutes between transmissions and not less than two minutes on-air time, with a few fixed-time transmissions to help the needy. Sadistic organisers also hide the transmitters and crews as well as they can in bramble bushes, holes in the ground and up trees etc., just to fool you!

Basic Receiver Requirements

1) Directional antenna—ferrite rod or frame/loop.
2) Sturdy construction—it tends to take a beating.
3) Light weight and reasonably small—you have to carry it with you.
4) Reasonably stable—it does not help if it drifts off frequency.
5) Reasonably sensitive—the station may be low power or some distance away.
6) Capable of being made less sensitive at will—you still need a bearing close in.
7) Simple to operate—keep it simple stupid (KISS).

Part 2

In the second part of this article the construction details of of the author's set will be given. Further details of "d.f.-ing" in general can be obtained from the RSGB, Alma House, Cranborne Road, Potters Bar, Herts. EN6 3JW, or the author, 27A Thorn Lane, Four Marks, Nr. Alton, Hants., GU34 5XB, Tel. Alton 62839.

the things people say

I was thinking of buying a one transistor 1–30MHz 200W all-mode transceiver.

. . . heard by R. Khatchadourian, Greece

I have no definite plans for antennas as yet and am having to make do with an indoor 8-element dipole.

. . . heard on GB3GN by GM6JZA

Have you heard any (printable) comments, funny peculiar or funny ha-ha? If so, why not send them in to our Editorial offices at Poole. We will pay for every one published.