Antenna Workshop

LOOPING LOW-DOWN - An Antenna For The 136kHz Band

Richard Q. Marris G3BZQ describes a multi-turn receiving loop for our newest band of 136kHz. So, read on and get 'the low down'.

The recent introduction of the European 136kHz amateur band has added a new challenge to the hobby. This new band is located below the 'bottom end' of our long wave (l.w.) broadcast band, and actually covers 135.7 to 137.8kHz. Looking at it another way, when on 136kHz you'll be transmitting and listening on a wavelength of 2206m!

As more European countries are authorising the use of the new band, it is hoped that, across the Atlantic, the Federal Communications Commission (FCC) in Washington will eventually authorise US amateurs to use 136kHz. For many years there has been the USA 1750m (160-190kHz) experimental band, fortunately for them, there are no l.w. broadcast stations on North America so, such a band is operable. It would, however, be impossible here, in Europe where it would be swamped by the multi-kilowatt l.w. broadcast stations.

Antenna Question

The question of an antenna for 136kHz presents real problems. Why not use the good old faithful popular dipole? It is extensively used throughout the h.f. bands. Well to answer the question - a half-wave dipole at 136kHz would be just over a kilometre long! Using metric or imperial dimensions, it's still a mighty long piece of wire!

In practice, any antenna used for transmission on this amateur band, will probably consist of as much wire as possible outdoors and matched heavily with a loading coil, etc. Such a loaded long wire antenna can be very a efficient noise collector!

In the days when this vintage amateur started playing with 'wireless' on l.f., the general rule seemed to be, that the longer and higher the antenna, the more stations would be received! This theory certainly worked in my parental home in Devon. In those days of the distant past, apart from atmospherics, man-made QRM seldom seemed to enter into the picture.

These days, apart from QRM from other stations, the proliferation of man-made noises gets worse year by year with the ever-increasing electric, electro-magnetic and electronic wizardry. When all this is added to atmospheric noise, they can produce a diabolically noisy situation when searching the l.f. spectrum.

However, the 136kHz loop which I am going to describe produces excellent signals that are lost in noise with a 30m long antenna (loaded or otherwise). An antenna that has a frequency tuning range (of the prototype) of 115-170kHz (or 2609-1756m). It also has directivity with a 'figure of eight' pattern.

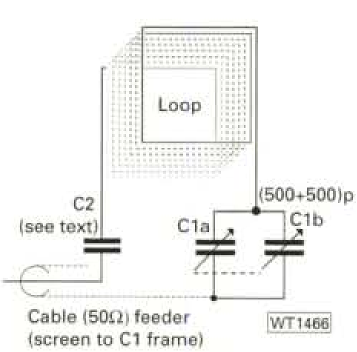

Fig. 1: The 'circuit' diagram of the Low Down Loop. See text for dimensions.

Loop Schematic

The 'schematic', **Fig. 1** shows a 915×915mm loop containing 22 turns of wire. It's resonated onto frequency by a 1000pF variable capacitor (made up of a parallel combination of a dual 500+500pF capacitor), shown as C1a and C1b (which I'll now just call C1) in the circuit diagram. A simple coupling arrangement, via C2, connects the loop to the receiver antenna input via coaxial feedline.

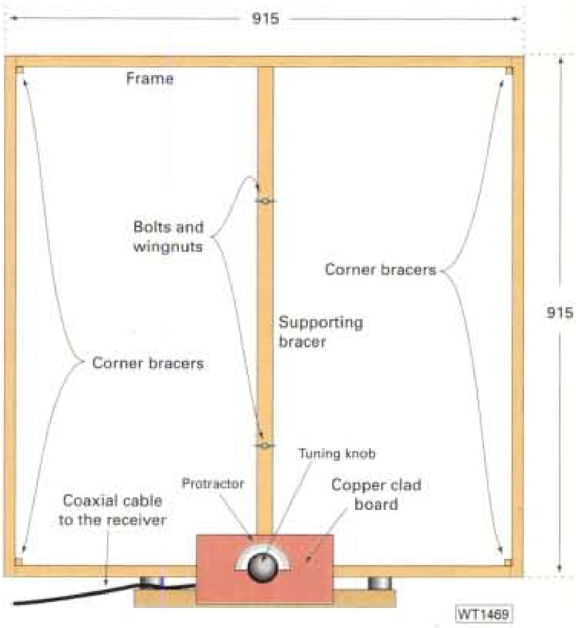

Fig. 2: Front view of the loop antenna, which uses over 80m of wire in 22 turns around the frame.

More detail of the construction of the loop and its layout are shown in **Fig. 2** and **Fig. 3**. In these illustrations you see a square loop frame, supported by a vertical pole, attached to a heavy baseboard. The variable dual capacitor C1 is mounted on a small control panel with a calibrated dial. The coaxial feedline exits via a socket located to the left of the front panel.

Construction

So, let's now turn to the loop construction. Referring to the illustrations, construct a square frame with outside dimensions of 915×915mm using 33×12mm section timber. A vertical stiffener, or support member, is fitted vertically in the centre, and flush with one edge of the frame. The whole frame should be securely glued together with corner blocks. I've given measurements in the units used (inches or millimetres) when purchasing the items themselves.

The winding for L1 (**Fig. 4**) around the circumference of the frame uses solid core *pvc* covered wire - 1/0.6mm wire with an overall outside diameter of 1.2mm . The use of *pvc* covered wire effectively separates and insulates each turns of wire.

The first layer of the winding comprises 16 closewound turns. Over this is wound one turn of

Shopping List

C1 - A dual 500+500pF variable capacitor, air spaced rigid type. (a Jackson type E was used on the prototype)
C2 - Silver mica capacitor 470pF (see text for possible alternatives)
1 Reel of *pvc* covered wire (1/0.6mm copper - 1.2mm o/d - Maplin PA56 L)
1 8×4 inch single sided copper-clad fibreglass panel (Maplin HX01B).
1 Coaxial surface mounting type socket (optional)
1 Large diameter instrument knob
1 0-180° protractor and some white card
5m of 33×12mm planed hardwood
1m of one inch wooden dowel

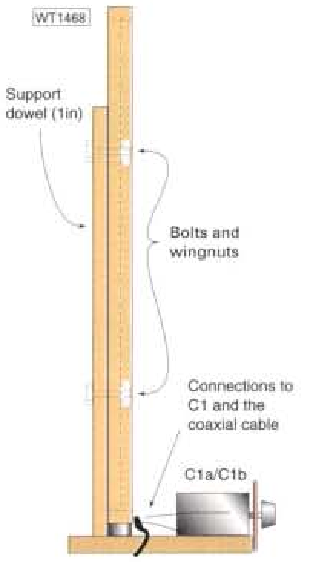

Fig. 3: Side view of the loop antenna, showing how the frame is attached to the support pole with two bolts and wingnuts.

masking (or insulating) tape around the circumference of the loop. The second layer of the winding is six close wound turns over the masking tape. The ends of L1 are taken through small holes, drilled in the loop base limb. After testing another layer of *pvc* tape is lap wound around the complete winding and frame.

Heavy Base

A heavy base must be constructed to prevent the loop overbalancing. The base I constructed consists of a piece of timber 360×160 some 20mm thick (see **Fig. 5**). Towards the rear, as shown, is a one inch (standard size) diameter vertical support pole, some 600mm long. The dowel is supported by securely fitting and gluing it into a one inch diameter hole which is bored some 30mm from the rear of the baseboard.

The front panel is a standard 205×102mm (8×4in) single side copper clad board (ex Maplin), fitted to the centre front of the baseboard, with two wood screws. The main tuning capacitor, C1, is mounted on the panel, as shown, and fitted with a large instrument knob. On the panel, behind the knob is fitted a 0-180°C protractor, backed with a piece of white card. A coaxial socket is fitted on the baseboard in the left-hand front corner.

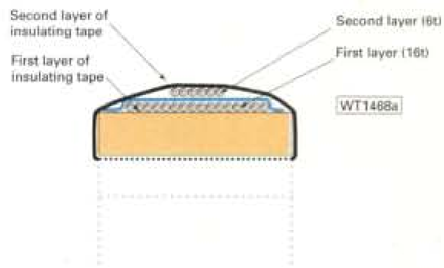

Fig. 4: A cross section through the loop showing how the 22 turns of wire are wound in two layers, the first with 16 turns side-by-side, the second layer of 6 turns is wound over the centre of the first winding.

Final Assembly

The central vertical limb of the loop is fitted to the vertical pole with two bolts with wing nuts as shown to allow the loop to rest on two rubber doorstops that are screwed to the baseboard. These two extra support stop the loop moving around too much.

The loop frame is lightly pressed against the rubber stops and two holes drilled for the two fixing bolts and wing nuts.

The 50Ω impedance coaxial feedline (RG58 as short as possible) to the receiver should be mounted on the baseboard in the position shown.The short length of coaxial cable is taken to the base of the pole behind C1 - it should be securely attached to the baseboard. The simple wiring, as Fig. 1, can now be completed.

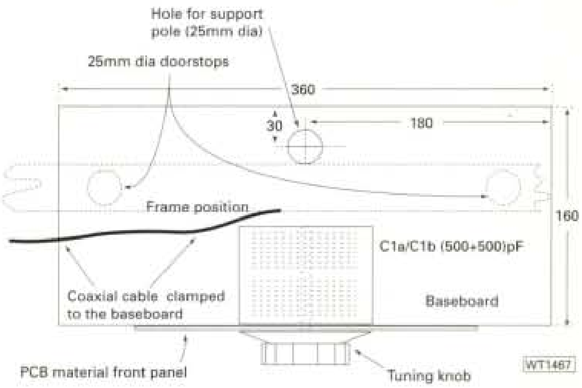

Fig. 5: A plan view of the baseboard. This should be quite heavy to give some stability to the completed antenna.

Testing & Operation

If the receiver has a 50Ω impedance antenna input, C2 can be a 470pF silver mica capacitor. For receivers with 70/75Ω input impedance, a length of 70Ω TV type coaxial feedline should be fitted. If 300Ω twin feedline is used (as with some older valve receivers), it may be necessary to experiment with the value of C2.

I use a Palomar VLF-A converter into a good 3.5MHz band receiver. I've found that the gain of this converter is such that a pre-amplifier isn't necessary.

The receiving system should be set to a steady, weakish signal near the centre of the 136kHz band. Capacitor C1 should be adjusted for maximum signal - the loop's maximum signal will occur when the edge of the loop points towards the station. A complete, or partial, null will occur at 90°, when the flat side of the loop is towards the station.

My loop antenna, which is indoors, where it stands on a table near the operating position, has captured a wide variety of stations, many of which were lost in noise with a 30m matched long-wire antenna. So, now you don't have an excuse for not, at least, listening to the band. Now you've got the 'low down'!