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Antennas

A design is offered here for those who like experimenting with small (or not-so-small) loops.

The conventional transmitting loop is a solution to HF operating from a site where there is insufficient room to erect a conventional wire antenna. It comprises a loop of large diameter tubing tuned by a substantial capacitor. The reason for this heavy engineering is the very high currents involved; these are typically 15 to 20amps through the loop element and capacitor when fed from a standard 100W transceiver. The efficiency of the loop antenna is the subject of much debate [1], and can be from 10% to 50% depending the coupling into nearby electromagnetic obstructions and other factors. A low insertion loss transformer/balun is also necessary to match to balanced loop to 50Ω coaxial cable.

THE I5TGC LOOP ANTENNA

An alternative loop has been designed by Cesare Tagliabue, I5TGC. This antenna employs inductive rather than capacitive loading and the one about to be described operates on frequencies from 14 to 28MHz. The I5TGC antenna, shown in the photograph, actually comprises two loops set at 90° to each other in an 'X'-configuration to allow the selection of polarisation.

The electrical length (see **Fig 1**) of the loop is a half-wave at the lowest frequency (in this case, 14MHz.). This is made up from the lengths of the conductors A to B (1500mm), C (1500mm), two lengths of D (700mm), plus the inductive and capacitive loads. Details of the loop construction are shown in **Fig 2**. The diagrams are I5TGC's originals, and anyone interested in building the antenna can obtain the full-size diagrams (including the ATU and the loop switching mechanism) from me on receipt of an A4 or A5 SAE.

Other dimensions are:

Inductive load = 6 turns 235 mm. diameter.

Capacitive load = 1 ring 235 mm diameter.

Sections A, B are constructed from aluminium tubing 16/12mm diameter.

Section C is made from aluminium tubing 12/10mm diameter.

The coils and capacitive rings are aluminium tubing 6/4mm diameter and the coils are supported with MOPLEN rods, fixed to the coil ends and some intermediate turns.

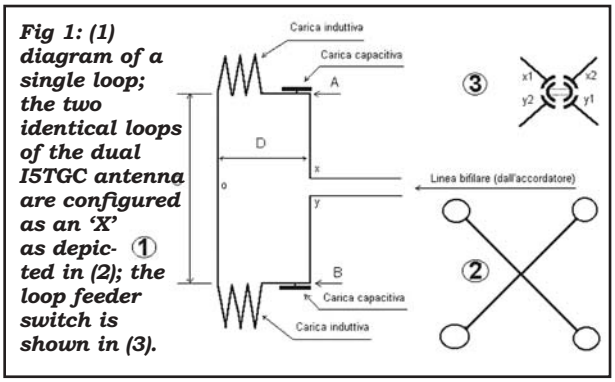


Fig 1: (1) diagram of a single loop; the two identical loops of the dual I5TGC antenna are configured as an 'X' as depicted in (2); the loop feeder switch is shown in (3).

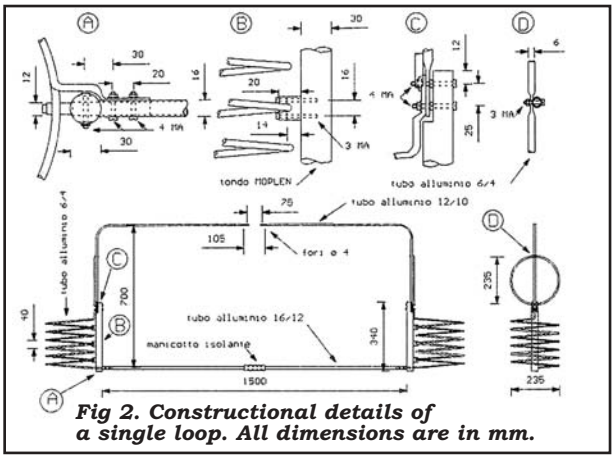
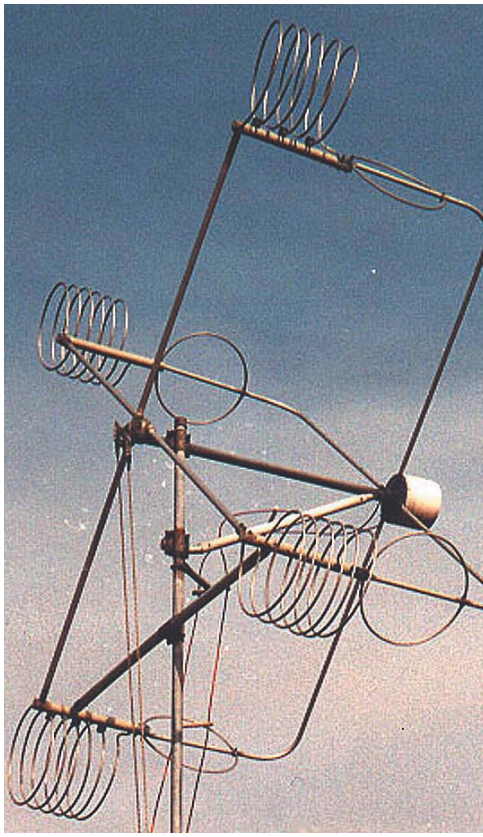


Fig 2. Constructional details of a single loop. All dimensions are in mm.



The I5TGC loop antenna in position.

There is more than one way of looking at this antenna. On 14MHz you could think of it as a short loaded dipole, voltage-fed at the tips. On 28MHz it is more like a full-wave loop with a low-impedance feed. The main objective of this design is to increase of the efficiency, compared with a conventional loop, by increasing the radiation resistance.

As you can imagine, the feed impedance varies considerably over the design frequency range. This problem is solved by using a true balanced ATU and 450Ω balanced twin-wire feeder. The ATU used by I5TGC is situated relatively close to the antenna and is remotely-controlled from the shack. This arrangement allows the open-wire feeder to be relatively short to minimise losses caused by the high SWR. This arrangement also allows the crossed loop to operate on 10 and 7MHz. In this case, the antenna works more like a conventional loop with noticeable losses compared with the design frequency range.

As already stated, the feeder is connected to the extremities x, y, of one of the loops (Fig 1 part 1). Points x, y, of the other loop are connected to a switch, a diagram of which is shown in Fig 1 part 3. This switch allows the loop not directly connected to the feeder to be connected with 0° or 180° shift relative to the fed loop - or not fed at all. By this means, very quick variation of polarisation, horizontal, vertical, or oblique can be selected. The switch is remotely controlled by means of two nylon cords wound on a drum driven by a small motor. This antenna is fully insulated from the mast, constructed on a small boom of PVC high-pressure tubing.

OPERATION

I5TGC notes that the polarisation of most signals is elliptic, with horizontal and vertical polarisation at the same time. However, on some propagation paths, only one polarisation plane is present; in this case a switchable loop is a distinct advantage when working some DX stations.

This loop has proved to be an effective DX antenna, with countries such as VP8, BV, JW, and many others, being worked in pile-up situations.

This antenna was described in *RadioRivista*, the official magazine of the ARI (Italian Radio amateurs Association) in October 1996. The extent of the experimental antenna work done by I5TGC can be seen on his website, see below. ◆

REFERENCE

[1] This subject is covered in great detail in the new RSGB book International Antenna Collection, available from the RSGB Shop.

WEB SEARCH

I5TGC http://dai5tgc.dadacasa.supereva.it