Magnetic loop for 20 to 6 metres

Introduction

Last year I made a 40 centimetre diameter magnetic loop antenna for pedestrian mobile. Covering 21 to 50 MHz, the SummerLoop produced some good VHF Field Day and interstate contacts when conditions were good. It's demonstrated on videos made at the time.

I've since made a SummerLoop II using parts from the original. The main loop is now formed from aluminium bar instead of coaxial cable. A gamma-type feed arrangement replaces the smaller loop. And builders have the option of attaching a parallel capacitor to cover 14 and 18 MHz. The result has narrower bandwidth, which in magnetic loops is a sign of lower resistance and greater efficiency.

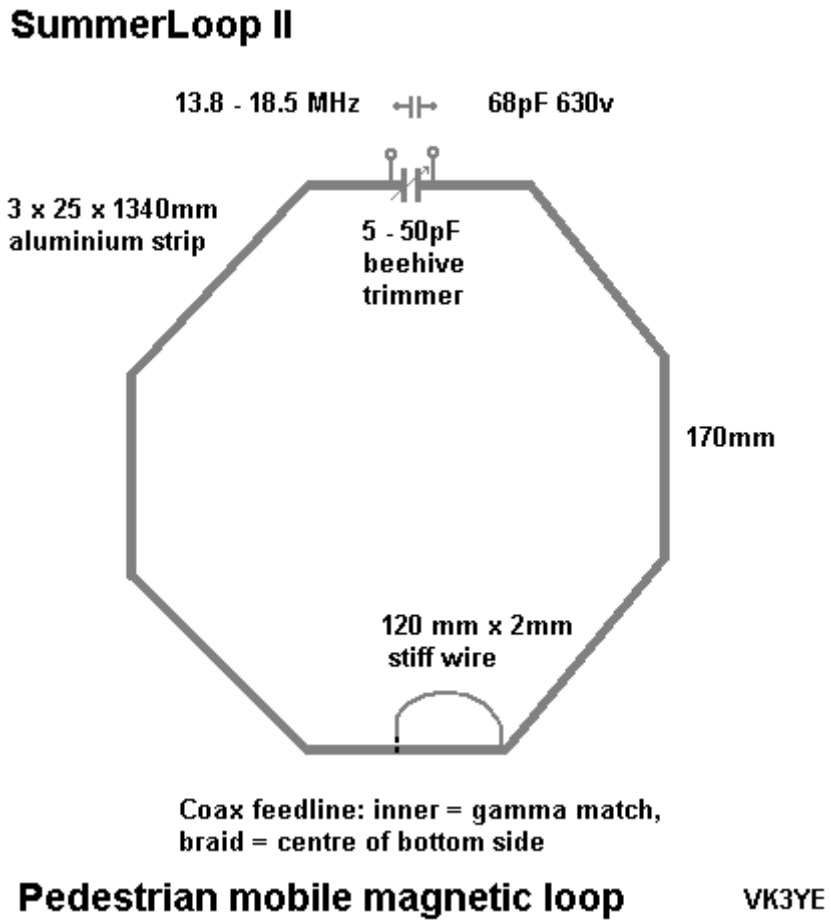
Main element

Low resistance is the name of the game. That means a thicker (and preferably smooth surfaced) conductor. Coax braid used in the original is better than regular wire but inferior to metal bar or tubing.

The hardware store presented two main choices; 12 or 19mm annealed copper tubing or

aluminium bar. Both are available in 3 metre lengths, allowing one piece to make two loops.

Copper is preferred due to its solderability and lower resistance. However I used aluminium bar for its light weight and the potential to form it into a capacitor (more later). The loop pictured here uses a 1340 mm length of 25 x 3mm aluminium bar. It is bent into an octagon with a 1cm gap at the top.



Variable capacitor

I initially wanted to replace the 50pF beehive trimmer with a home-made capacitor formed from the antenna's main element. The idea was to bend both ends of the main loop down to face one another. These were screwed to chopping board material and steadied with four bolts. Gaffa tape on each facing surface of the capacitor prevented shorting. Tightening the bolts would increase capacitance, much like a compression trimmer.

A somewhat larger loop than described achieved resonance from 14 to 50 MHz. The homebrew capacitor could withstand about 30 watts before arching over. Unfortunately

tuning was extremely touchy and SWR jumped around, especially when the loop flexed when hand-carried. The idea has potential, especially for single band or fixed location loops, but for multiband pedestrian mobile use I reverted to the original beehive trimmer arrangement.

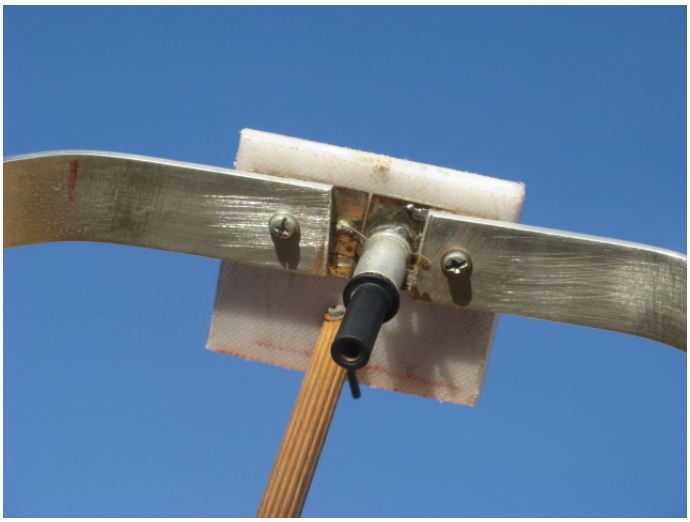
As in the first loop the trimmer is mounted on a 70 x 25mm piece of fibreglass printed circuit board material. This must be single sided copper to lessen capacitance. A knife or hacksaw is used to separate the copper into two large pads, each connected to a terminal of the capacitor.

Screws hold as much of each pad as possible against each end of the flat aluminium loop. Sand the facing surfaces to lessen resistance. If the loop is to be used permanently outside as a courtyard or balcony antenna, consider the risk of reaction between dissimilar metals and waterproof accordingly (this goes for any antenna project, not just magnetic loops).

Use 4 mm diameter screws to hold the loop ends to the circuit board. Install so their heads are pointing down. They should be long enough for there to be about 20mm thread protruding from the nut. The reason for this is mentioned later.

A square of kitchen chopping board material adds rigidity to the top of the loop and lessens stress on the circuit board. A 9mm hole allows a snug fit with the 9.5mm vertical dowel that comprises the antenna's handle.

An insulated knob on the capacitor lessens hand-capacitance and makes adjustment easier. Again the hardware store came to the rescue, providing a pack of 4 rubber wall mounts used to hang items on brick walls. The non-threaded end happened to fit snugly onto the rotating section of the trimmer capacitor. Flexible rubber or clear plastic tubing could be another option.

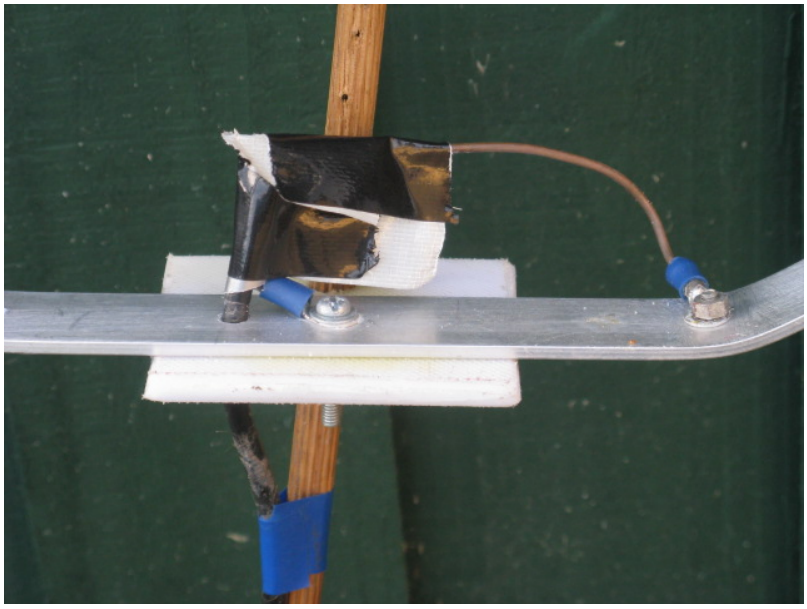


Feed arrangement

The first loop used a smaller feed loop. It worked well but sometimes needed to be squashed to get a 1:1 SWR.

This loop uses a gamma-style feed. Flexible wire with a crocodile clip was initially used to find the point where the loop provides a 1:1 SWR at resonance. It should be a little less than 10% of the loop's circumference around from the feedpoint.

I initially tried aluminium bar for the gamma feed but was unable to get as good a match as the wire. It was replaced with stiff 2mm diameter coathanger-type wire.



Extra bands

Being restricted to the 21 to 50 MHz bands, such as with the original SummerLoop, is a major limitation for those wishing to make contacts throughout the year. This is because for most of the time there is either no propagation, no activity or signals are unworkably weak.

During such times 14 and 18 MHz coverage is handy, even if at reduced efficiency. This is achieved by adding a fixed capacitance across the trimmer. While not planned this way, a 68pF polystyrene capacitor serendipitously allowed coverage of 14 MHz with the trimmer nearly meshed and 18 MHz with it nearly open.

A 630 volt capacitor is adequate for five watts. If you only have lower voltage rated capacitors, then two or more wired in series relieves voltage across each one. 120 and 150 pF in series will provide close to the required 68 pF.

Though desirable for low resistance, a soldered connection is impractical as the capacitor must be removed for higher band coverage. Instead I mounted it on a piece of chopping

board. It has two banana sockets which mate with the 4mm bolts that hold the beehive trimmer.

Results

The SummerLoop II was first used during the 2012 Winter VHF/UHF Field Day. Several local contacts were made on 6 metres SSB and 10 metres FM. Despite the antenna's inefficiency the best results were had on 20 metres, with contacts up to 2000km.

As expected even better results were had over summer. Interstate VKs, JA and Europeans have all been worked on 10 metres, while ZL (about 2500km away) was contacted on 6 metres, pedestrian mobile CW.