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G4TPH Loop Antennas

Tony Jones G7ETW takes a look at a couple of loop antennas by G4TPH, an update on previous PW reviews of earlier G4TPH products.

Fig 1: The kit of parts on arrival.

Fig. 2: The assembled 10-strut loop.

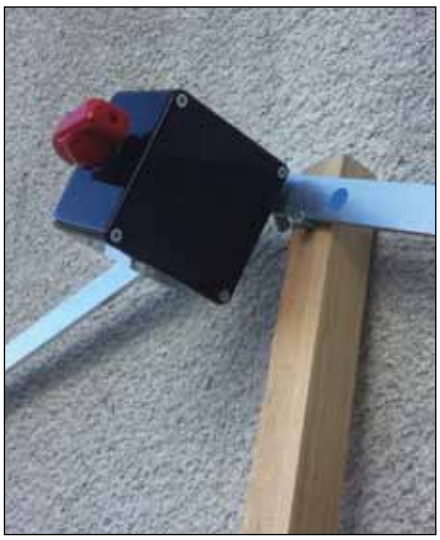

Fig. 3: The tuning box.

This review is of a magnetic loop antenna, made and sold by Tom Brockman G4TPH. There are two versions, the ML40-HP Mk2 and the ML40-HP Mk2 Remote. The ML40-HP Mk2 antenna comprises ten aluminium struts (400 by 16mm), a tuning capacitor box and a coupling transformer box with a BNC socket on it, plus nuts, wing-bolts and washers. The ML40-HP Mk2 Remote is the same except that the manual tuning capacitor box is replaced by a motorised one and a separate switch box.

Each antenna comes as a 'flat pack', **Fig. 1**, with good instructions. Two of the pre-drilled struts have smaller holes to fit the tuning boxes and these are clearly marked with blue spots. The struts need to be bolted together to make the loop. Tightening the wing-bolts by hand to make the loop rigid enough to keep its shape is very hard work, so I used a screwdriver and a pair of pliers. One of the claimed advantages of using a series of struts rather than a continuous loop is that it's easy to pack down (for portable operation, for example) and can be taken into confined spaces (such as a loft) before assembly.

No setting up is needed other than to decide which set of bands to make it for. With ten struts, the antenna covers the 40, 20 and 15m bands and is 1275mm in diameter. For 12m and 10m, leave three struts out. The diameter is then 900mm. To tune for a band, the procedure is wonderfully 'old-school': choose a quiet frequency close to mid-band and peak up the receive noise by carefully turning the capacitor.

The photograph, **Fig. 2**, shows the manually tuned antenna with the ten-strut loop. **Fig. 3** shows the capacitor box with one of its matching blue-spotted struts.

Testing Testing

Before attempting to transmit, I did a lot of tuning testing and I was impressed by how well this works. Tuning by ear, I consistently got better than 2:1 matches on all bands the antenna is designed for. Using an antenna analyser I got even better results, including a perfect 1.0:1 VSWR on 40m. Once the 'sweet spot' on the capacitor has been found, the VSWR across that whole band stays useably low.

I also checked some bands the antenna is not designed to work on after I was surprised to hear my local 2m repeater when I changed bands inadvertently. If this was the only antenna I had available and I needed to get on air urgently for some reason, I would certainly consider using it 'off-piste'.

The photograph, **Fig. 4,** shows the 40m VSWR readings as measured on my MFJ analyser. **Table 1** details measurements on several bands, including VSWR readings at the band-edges for 20 and 40m.

Initial testing was done at my flat but that's a poor location for HF and I was delighted when an opportunity arose to give the antenna an outing. On September 4th my local club, the Radio Society of Harrow, attended a public event in conjunction with the Metropolitan Police. **Tom Reilly G0NSY**, an ex-police officer and the club president, had arranged for the club to put on an HF station to promote the International Police Association (IPA) by using the callsign GB4IPA.

I assembled the antenna for 40m and hung it with nylon fishing line from a small tree, the feeder connecting a couple of

feet off the ground. This may sound like a terrible way to deploy an antenna but it is precisely as per the instructions. With so many people around, we didn't want any more cables than were necessary so we didn't use the remote-tuning option. Instead we relied on two-person tuning, one operator at the antenna and the other at the radio, using hand signals to indicate the noise level on receive. Why hand signals? Because of the noise: not electrical noise – we were in a park, a hundred metres from the nearest building – but acoustic noise. Children were having a grand old time trying out the 'blues and twos' in a nearby police car and there was a public address system playing music as well!

Table 1: Some VSWR results achieved using 'by-ear' tuning.

Freq (MHz)	VSWR
6.999	1.4
7.091	1.3 (40m band tuned at this frequency)
7.199	1.4
14.004	1.2
14.110	1.1 (20m tuned at this frequency)
14.353	1.3
50.963	1.7
70.428	1.7
145.000	2.0

Table 2: Stations worked at Metropolitan Police Event

F5KEE, G2XV/P, OR4O/P, ON4EJO, ON6WL/P, ON7TR, RW1F/P

Fig. 4: Measured SWR and impedance on the 40m band.

Fig. 5: The 10/12m loop with remote tuning box.

Fig. 6: A close-up of the remote tuning box.

GB4IPA Activity

We started operating on 40m using a Kenwood TS-570 and 100W of SSB. The 40m band was only in fair shape and there was a contest on. We had a few good QSOs, mainly to Northern Europe. When we were heard, the other station usually replied straightaway, giving us a five and nine signal report (perhaps somewhat meaningless because this is pretty much standard during contests!). **Table 2** has a list of some of the stations we worked. To any contest stations we worked I apologise – we didn't enter a log.

There were many stations we heard but could not work, including GB0APS, an all-female special event station operating at the Leicester Pumping Station on 7.130MHz. We tried for a good 20 minutes but couldn't break through the pile-up. If you read this **Sandra** or **Linda**, I'd be interested to know if you heard us.

When 40m all but closed, we tried 20 and 15m but had no luck. We had an L-shaped vertical up as well, which should have favoured shorter wavelengths but when we switched to that it was no better. So I think the band conditions, not the antennas, were to blame. My fellow club members were amazed that a small loop antenna could do so well on 40m.

I didn't take any 'radio' pictures at the Metropolitan Police Event. I'm sorry but it felt intrusive, with so many members of the police and their families about.

Remote Tuning

Testing the antenna with remote tuning was done at my flat. The manual tuning box is replaced with a much larger motorised capacitor box that has a side-mounted BNC socket. This coaxial connection provides DC (6.0 to 15V) of reversible polarity to a powerful motor. Why coax for a DC connection? Partially to keep RF out of the switch box and motor, Tom told me, but mainly because radio amateurs are more likely to have spare BNC RF leads than lengths of twin-core.

The motor has quite a kick to it and draws 700mA. The gearing ratio is 3000:1 so tuning is smooth and controllable. The instructions recommend the use of a small (ideally linear) mains PSU but I used a 12V 5Ah 'gel cell', which was perfectly adequate. At a pinch, this could be run off a PP3 battery. Tom can supply a suitable PSU and fly lead if required.

The photo, **Fig. 5**, shows the 10m loop with the remote tuning capacitor fitted, while **Fig. 6** shows the remote tuning box, in two parts. The larger box houses the motor and the smaller box has the tuning capacitor in it. Again the blue spot on the strut can be seen. **Fig. 7** shows the switch box, with no DC supply.

Thoughts and Conclusions

The build quality is excellent and the component parts are of good quality. The photo, **Fig. 8**, shows the boxes with their lids removed. That motor is a monster!

Tom used to sell two band-specific versions: the ML-20, which had eight struts and covered 20 to 10m, and the ML-40 with 12 struts, covering 40 to 20m. These antennas have been reviewed by *PW* before, first by **Tex** in 2007 and again by **Ben Nock** in 2011. Both reviewers liked the antennas, having reasonable success with them, and recommended them for portable operations.

In use, nothing much has changed. The 2016 versions are still well made and come to pieces easily for ease of transportation. The key to this is the

Fig. 7: The switch box as used at the shack end.

coupling unit, which one strut passes through, making the loop the secondary winding of an ingenious toroidal RF transformer. Tex drew our attention to this nearly ten years ago; it was a good idea then and it still is.

These are the obvious improvements in this, the third generation of Tom G4TPH's antennas. These include complete 40 to 10m coverage in one antenna with no need to change tuning capacitors or coupling transformers, a smaller loop (ten struts rather than 12) and 100W power handling (on SSB; the recommended CW limit is 50W). Previous models were QRP only.

The option of remote tuning is also a plus. The antenna could be hung in a loft and be the main station antenna with the switch box in the shack. No ATU would be needed.

I suppose the acid test of a product review is *"would I buy one?"* Well, let me be absolutely straight about this. I am a QRP operator, partially from circumstances but mainly from preference, so I would never need a 100W antenna. I usually just throw a wire over into a tree for my portable operating.

I like the build quality of Tom's antenna (and yes, he does still drill and trim the struts himself, see **Fig. 9** for a detailed view) and how easy it is to tune. Correct tuning results in an antenna with useable VSWR across the whole of each band. The antenna – manual or remote tuning versions – is very light, and can be hung off anything handy so it is perfect for portable operations. The fact that it breaks down to small pieces means it could be erected in small spaces.

For public events, where safety is always a worry, the antenna has advantages because it only needs one support (and not a high one) and there are no remote ends with high voltages present. It also looks quite 'technical', by the way. At the Police event quite a few people asked what it was, which led to explanations of what amateur radio was and two young men expressing interest in taking a Foundation course.

But would I buy one? I'm thinking about it! Ordering is via Tom's website, below. The manual tune version is £94 and the remote tune version is £159.

www.g4tph.com

My thanks go to Tom Brockman G4TPH for the loan of his antennas and to **Peter Marcham G3YZB**, **David Tallaber G0CAG**, Steve O'Riordan 2E0NSY and Tom Reilly G0NSY for their valuable and enthusiastic assistance in doing this review.

Fig. 8: An internal view of the various components.

Fig. 9: The drilled and finished end of a strut.

Magnetic Loops for Beginners

A magnetic loop antenna, otherwise known as a 'small transmitting loop', is defined as one that has a circumference of less (often a lot less) than one third of a wavelength. About one tenth of a wavelength is a good rule of thumb. The capacitor forms part of the loop and is there to 'counterbalance' the inherent and significant loop inductance.

When the loop is tuned, the antenna becomes a tuned (LC) circuit with very high *Q*. This is why tuning is sharp and bandwidth generally low. Magnetic loops usually need to be retuned as the operator tunes up and down the band. Single band antennas are easier to implement.

The voltage across the capacitor plates can be very large, even at modest power levels. The capacitors in the review antenna are noticeably heavy-duty.

Unlike a dipole, a magnetic loop couples into an RF wave's magnetic field. This makes is far less sensitive to local electrical interference.

Magnetic loops are directional in the plane of the loop, that is to say 'edge-on'. This is counterintuitive because looking into the 'face' of a magnetic loop, it is easy to imagine RF being 'captured' by it but that is not how magnetic loops work. Mounting a magnetic loop antenna horizontally gives an omnidirectional (horizontal) response.

Efficiency is an issue with magnetic loops. This can be very low (5% or less) although it is possible to design and build them with efficiencies of 80% and more. It depends not just on the size but the thickness of the loop material.

Sometimes an antenna consists of more than one loop, with a smaller loop to energise the main loop. In some designs the feeder connects to the loop directly and there is a delta-type concentric conductor to assist in impedance matching. I could go on; there are many designs of magnetic loop antenna.