

PW REVIEW

Cap.Co Magnetic Loop Antenna AMA 5

During the autumn of 1987, Cap.Co Electronics Ltd. of Skelmersdale, Lancs, announced a new range of "home-grown" magnetic loop antennas for the s.w.l., amateur and professional markets, claimed to be a major technological breakthrough "rendering skyscraper antennas . . . as archaic relics of the past".

Being the proud possessor of a few of these archaic relics himself, Ron Stone GW3YDX decided he would like to put a magnetic loop to the test. His XYL Janet reports here on his findings.

The literature accompanying the antenna explains that it functions on the magnetic portion of the electromagnetic wave, and that this feature distinguishes it from "electrical antennas such as Yagis, dipoles, etc.". This review, however, focuses on the practicalities rather than on the theory behind the antenna.

Arrangements were made to borrow from Cap.Co the Model AMA 5, which covers the frequency range 3.5 to 10MHz, and costs £390 including its associated control unit. Tony Johnston G4OGP, Technical Director of Cap.Co Electronics Ltd., invited GW3YDX to collect the antenna from the factory at Skelmersdale, and at the same time to have a look round the production line for the loops and for the well-known range of antenna tuning units.

For some strange reason, GW3YDX had always imagined that the Cap.Co operation was conducted with a man and a boy from the back of a garage in the leafy suburbs of Skelmersdale. Nothing is further from the truth, for the factory already employs seven people, and three more were to be taken on during the week of the visit. Throughout the company, the issues of quality were evidently given the highest priority. GW3YDX, who is professionally engaged in electronics, was impressed both by the total quality attitude and the company's modern machine tool and electronic test equipment.

Prices for the loop antennas range from around £80 for a receive-only model, up to over £3000 for the high-power professional versions which come with microprocessor-based automatic control units. Sizes range from 680mm to 3.4m in diameter, depending on the frequency coverage. The claim that the antenna does not need planning permission holds true for all the loops except the big AMA 1. The 1.7m-diameter AMA 5 and smaller

loops don't need permission unless any part of them exceeds 3m above ground level. This means that the AMA 5 on a 1m stand can go into any garden and the local authority cannot tell you to take it down on planning grounds. Table 1 gives full details of the range of magnetic loops available.

Mechanical Details

The quality of construction of the review antenna was very good, and it was obviously built to last. The tubing is heavy gauge aluminium alloy about 32mm in diameter, with the associated fittings heavily plated to resist corrosion. Heavy duty polypropylene plumbing fittings are used to waterproof the joints between the tubing and the large plastics tube containing the remotely tuned components. The reviewer has pledged to Tony Johnston that he will not divulge manufacturing details, but can reveal that the antenna consists of a loop which couples by transformer action into the tuned circuit comprising the tubing loop and a motor-driven variable capacitor. It sounds simple, but the capacitor is a very special high-voltage component, and the motor and drive have several unique features. The mysterious piece of plastics drainpipe conceals some expensive precision components, which account for the high price of the antenna, and also mean that this is not an easy home-brew project even if only medium transmitter powers are involved.

All the antennas come with a mains-powered manual controller which connects to a waterproof socket on the antenna via an ordinary screened single-conductor cable. The r.f. connects via 50Ω coaxial cable to a PL259/SO239 connector on the antenna. Connections were quick and easy to make.

The controller has fine and coarse tuning buttons marked HF and LF, in

other words 4 buttons in all, a toggle switch to go from fine to coarse tuning, a "speed" control to vary the rate at which the reactive components tune, and a press-button mains on/off switch. Several loops can be driven from a single controller.

Operation

To make it all work, the receiver or transceiver is tuned for a peak in noise from the loudspeaker. Using the coarse tuning buttons is the fastest way to tune the antenna, but because the beast has such a very high Q it is very easy to miss the tuning peak. Once a peak is found with the coarse controls, you then switch to fine tune and repeat the process. Then it is time to tune up, "bearing in mind other band users" as the instructions quite rightly say. Pressing the fine HF or LF buttons as appropriate, whilst watching the v.s.w.r. will obtain the desired low reading. You are then ready to go.

It all sounds much more complicated than it is to do, and the procedure was quickly got used to, using the excellent instructions supplied. It is a good idea to bear in mind whether one had moved l.f. or h.f. around the band, as usually a quick touch on the appropriate fine tune button would return the antenna to 1:1 v.s.w.r. after a QSY.

The match after tuning was at worst 1.3:1, and more usually 1:1. This should satisfy the fussiest transmitter. No TVI or BCI was evident, although of course this usually has more to do with the quality of the receiving equipment than the transmitter/antenna combination.

The very small bandwidth of the antenna is at the same time both a blessing and a curse. On the one hand it in effect adds another high- Q stage to the receiver, which would be of great benefit if a local medium wave broadcast transmitter so overloads the front end of your receiver as to make listen-

ing on the 3.5MHz band impossible, or if you have a receiver with poor strong-signal handling capabilities. In this case, the sharp tuning of the loop may well be able to suppress the QRM. On the other hand, the sharp tuning makes a rapid QSY, especially around 80m, a bit of a tedious task. The very high *Q* of the antenna and its narrow bandwidth are claimed as two of the principal features by the manufacturer. So they can be, but there can also be a negative side, as already outlined.

The 2:1 v.s.w.r. bandwidth was measured on each band and compared with the claimed figures with the following results:

Frequency Band MHz	Bandwidth for 2:1 v.s.w.r.	
	Claimed kHz	Measured kHz
3.5	3	4.5
7.0	8	12
10.0	18	21

The overall frequency coverage of the antenna was 3.2 to 13.2MHz. It is a pity that it does not extend a little higher to give coverage of the 14MHz band, but there are other models which do.

On the Air

The performance of the antenna was compared with the main station antennas at GW3YDX. For the 3.5MHz band the choices are a 16.5m vertical with some 600m of radials, or a G5RV at 12m. For 7MHz there is a 2-element Yagi at 29m or the G5RV. On 10MHz only the G5RV is available.

Although it is possible to mount the antenna with loop parallel to the ground, in most cases it will be mounted upright, and it was tested in that mode only. Band by band, the results of comparative tests are as follows:

3.5MHz: On DX signals the loop was generally about 10dB down on the vertical. Bearing in mind the small size of the loop this is a very good result. Remember that 10dB is equivalent to about 1½ S-points. It was quite easy to work the USA. For local QSOs the loop was run against the G5RV, and again it was about 10dB down. It was easy to put a good signal into most of Europe. **7MHz:** Obviously the beam "blew the loop away" with signals up about 30dB compared to the loop. Using the G5RV on European signals, the loop varied from equal to about 10dB down. In view of the minute size of the loop compared with the G5RV, this is a surprisingly good result. Some good Caribbean DX was worked during the CQ WW Contest, though the loop was found to be about 10dB down on the G5RV for distant signals. This again was quite a good result, but not as good as with local signals.

10MHz: Results on this band were the most interesting of all. It soon became evident that the G5RV, being a full wavelength long on 10MHz, possessed some deep directional nulls on that band. Very often, signals that could be

heard at good strength with the loop were completely inaudible on the G5RV. When a signal was in the null of the loop and a good signal on the main antenna, it could usually be equalised by turning the loop. At worst, the loop was 5dB down, and frequently many dB up on the G5RV, because of the nulls of the latter. Not being able to turn a G5RV, this was a significant and major plus for the loop.

The theoretical gain figures on the data sheet do not seem to be realised. The dBd (decibels with reference to a dipole) figures are -7.05 on 3.5MHz, -1.82 on 7MHz and -0.03 on 10MHz. Having said that, theoretical gains are very difficult to achieve in reality, especially when it comes to miniaturisation and/or multi-banding. Without the attention of good construction and quality components that Cap.Co have put in on the production line, the field test comparisons against the main station antennas would have been a great deal worse for a small loop. Anybody who imagines that you can build a miniature multi-band antenna 1.7m in diameter and not lose a little must be a bit naive!

The literature that comes with the antenna claims that a rotator is not necessary. This is true in the sense that the loop, being at ground level, can be turned by hand. However, one of the big benefits was the ability to turn the antenna so as to drop signals into the null of the loop, thereby removing

either the hash from the junior op's micro-computer, or dear old Vlad who never listens before calling CQ. A rotator can save a lot of running to and fro, and would be a useful extra. It need not be a big one, as the loop is very light.

Power handling of the AMA 5 is claimed as 150W. Ever curious, the GW3YDX linear was fired up. The power accepted on each band before the v.s.w.r. shot up, indicating flash-over, varied between 190 and 210W depending on the band. This is plenty for most transceivers, and gives a little to spare in the unlikely event of not being able to tune the antenna to give a good match.

Conclusions

Is a Cap.Co loop going to grace the GW3YDX QTH? The answer is probably not, bearing in mind the excellent antennas that are already in place. Furthermore, noise is not usually a problem there. Having said that, the receiving version would frequently be of use in reducing the European QRM on Top Band And Eighty, so purchase is being actively considered. For the amateur who has severe QTH or planning problems, the Cap.Co range of magnetic loops could offer a solution.

Thanks go to Cap.Co Electronics Ltd., 63 Hallcroft, Birch Green, Skelmersdale, Lancs WN8 6QB, telephone 0695 27948, for the loan of the review antenna. **PW**

TABLE 1: THE CAP.CO RANGE

Type	Freq. (MHz)	Power/Use	Size (m)	Weight (kg)	Price
AMA 1	3.5/7.2	200W/TX or RX	3.4	15	£390
AMA 2	6.9/14.5	200W/TX or RX	1.7	10	£322
AMA 3	13.9/30	200W/TX or RX	0.8	5	£286
AMA 4	1.8/4.2	100W/TX or RX	3.4	16	£456
AMA 5	3.5/11	150W/TX or RX	1.7	11	£390
AMA 6	7/26.8	200W/TX or RX	0.8	6	£342
AMA 7	7/30	Receiving only	0.68	5	£79.95
AMA 8	1.6/10	Receiving only	1.0	6	£89.95
AMA 9	7/30	Commercial models for 500-1200W continuous, with auto-controller			£2-3k
AMA 10	1.8/7				£3.5-4k

Tony Johnston G4OGP, pictured with two of his magnetic loop antennas, standing outside the Cap. Co Electronics factory at Skelmersdale

