The Compact-A-Loop Antenna

80 meters for the apartment dweller.

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Many of us dream of a super all-band antenna farm. There is nothing wrong with this dream if you have the odd acre or two of real estate way out in the sticks. Good luck to those fortunate few. Many of us will have to rely on an unexpected windfall to provide the necessary shekels to achieve this dream. However, while waiting for the windfall, amateur transmitting life must go on. Many hams suffer from lack of space, from official and other diabolical restrictions, and often from a poor ground. The best idea is to design/tailor-make the best possible antenna to fit the existing space available. Such is the Compact-A-Loop.

I designed the Compact-A-Loop by experimenting with various 80 meter band horizontal loop configurations not needing any RF ground. It fits into a room with the transmitter located on a desk in the corner, and is easily adaptable for outdoors space.

Figure 1 shows the final Loop circuit, which is a horizontal delta shape with a 42' circumference (3' x 14' sides). The Loop can be resonated via a 2-gang variable capacitor (C3 and C4), and covers the whole 80 meter band (3500-3800 kHz). In parallel are ballast capacitors C2 and C5 (discussed later in this article). Connection to the 50 ohm impedance feedline is via C1, which is a coupling/matching capacitor. The usable bandwidth, without retuning, on the prototype is approximately +/-20 kHz of selected frequency. I tried other horizontal loop shapes, including square, rectangular, and some very irregular multisided shapes. The frequency range changed in all cases, and the bandwidth was narrower, down to +/-3 kHz in one case. Furthermore, to add to the complexity, the proximity of nearby objects affected both frequency range and bandwidth. Extensive experiments indicated that the final delta shape was way ahead of the other shapes. One very obvious reason for this is that it is possible to keep all 3' x 14' long sides well away from the walls (see Figure 2) and other objects. This gave the best usable bandwidth, best transmitter loading and range, and best received signals. Low RF power output of 7 or 8 watts CW was used in all tests, and is used in operation. No harmonic radiation or TVI was detectable.

The Loop is omnidirectional with a useful forward "hump" on B around the junction of B and C. Figure 2 shows how this "hump" has been oriented approximately east southeast,

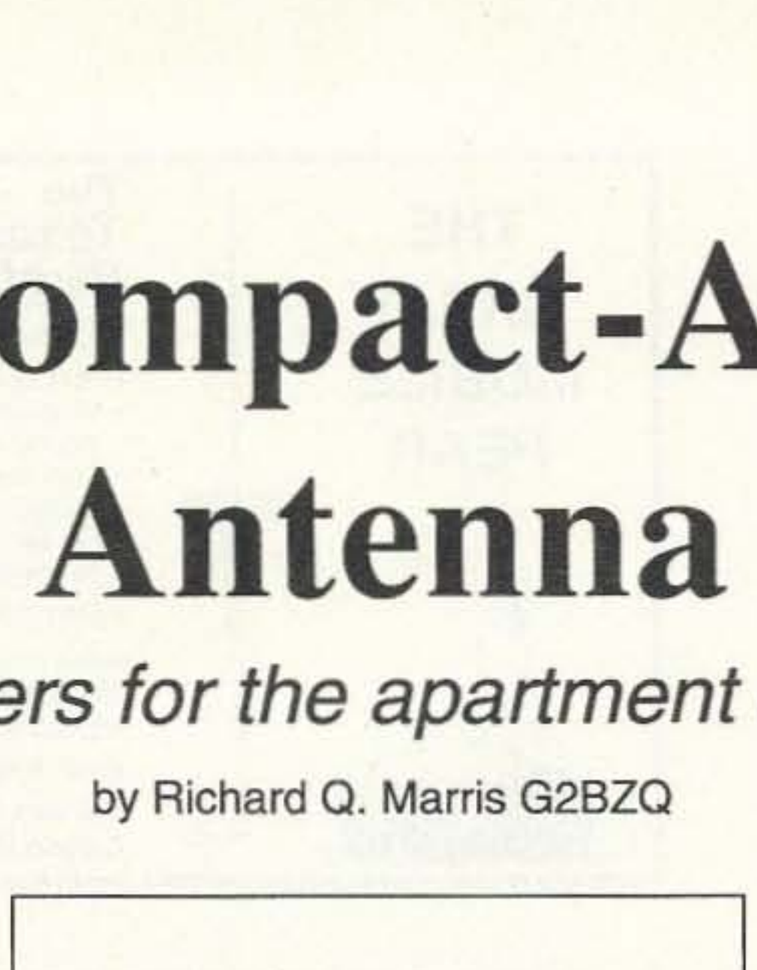

Figure 1. Diagram of the Compact-A-Loop.

giving a small peak right across Europe and well into the USSR. Ideally, this small peak should point westward to get maximum signals to North America, but this was not possible here. Apart from this small peak, the Loop is omnidirectional.

Construction

The Loop consists of 42' of white stranded #20 PVC covered wire This is quite adequate for low power operation. You may want to use larger diameter wire for higher power outdoor operation. The Loop was erected with three equal sides (A + B + C). It is held 10" below the ceiling, and is supported by lengths of 8 lb. breaking strain nylon fishing line which, along with the white PVC wire, is inconspicuous against a white ceiling. Figure 4 shows a space-saving compressed version, still using 42 feet of wire (discussed later).

The ends of A and C are dropped down 3" (Figure 2) and fitted with 4mm plugs (PL1 and PL2) to plug into the top of the tuning unit (Figure 3).

The Tuning Assembly

The tuning unit (Figures 1 and 3) is somewhat unusual. It is assembled into a plastic box raised from the operating desk by a vertical post so that the top is just below the apex of the loop, which plugs into sockets SK1 and SK2. A 1/4" (6mm) diameter wood dowel remote control shaft drops down so that the control knob is conveniently reached by just raising your left hand a few inches off the desk. The resonating variable capacitor (C3 and C4) is a 2-gang 210 + 210 pF with integral 3:1 reduction drive. An alternative would be to use another make and fit an external slow motion drive. C2 and C5 are 33 pF (750 volt) silver mica ballast capacitors, selected to ensure that the 80 meter band is fully covered. Alternative values, up to +/-15 pF, may be required if the Loop configuration is changed in shape. The frequency range may be affected slightly by the proximity of surrounding objects.

Coupling/matching capacitor C1 is a 150 pF ceramic (1 kV). It couples one end of the Loop to 5 feet of RG58 coaxial 50 ohm impedance feedline, which exits through a hole in the rear of the box, and is cleated at the back of the vertical post, down to the transmitter/receiver. In original tests C1 was a 250 pF variable capacitor—however, I found that 150 pF (on the VC) was optimum and not critical, so a fixed capacitor was substituted.

The tuning unit layout is shown in Figure 3a, and the actual mounting used here is in Figure 3b. The mounting can be adapted to suit individual requirements. If the Loop is erected in a loft or outdoors, a remote tuning arrangement will have to be devised. If the Loop is erected outdoors, it should be possible to put the tuning unit just inside a window. The plastic box I used had a metal panel which was replaced with a small piece of plastic sheet.

Operation and Results

The resonating capacitors C3 and C4 are tuned for maximum signal on "receive" at the desired frequency. For example, here it is often resonated at 3550 kHz, giving a usable range of 3530-3570 kHz without retuning C3 and C4. The transmitter is loaded into a dummy 50 ohm load in the usual way. On "transmit" with the Loop connected, only a very minor adjustment of C3 and C4 and transmitter loading may be needed—if at all. The frequency range can rapidly be achieved by adjusting C3 and C4.

I made a first tentative CQ at 0400, using 7 watts CW output when the conditions were

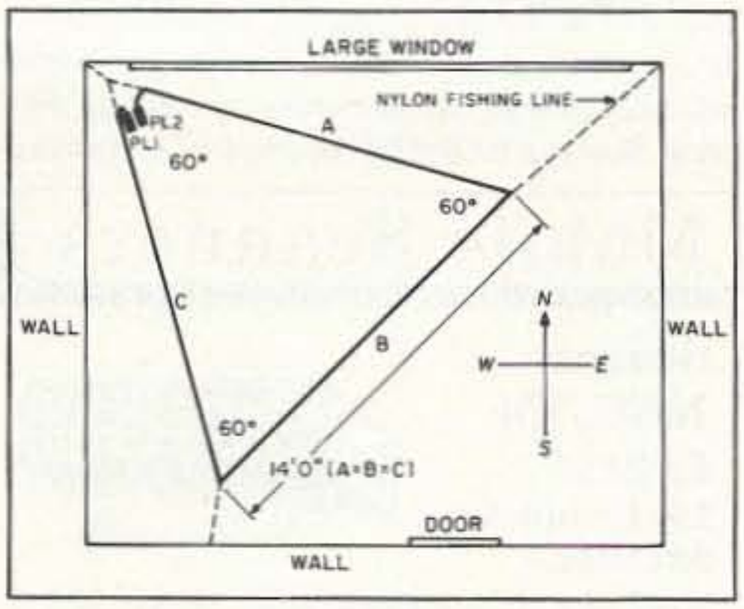

Figure 2. Installation of the Loop.

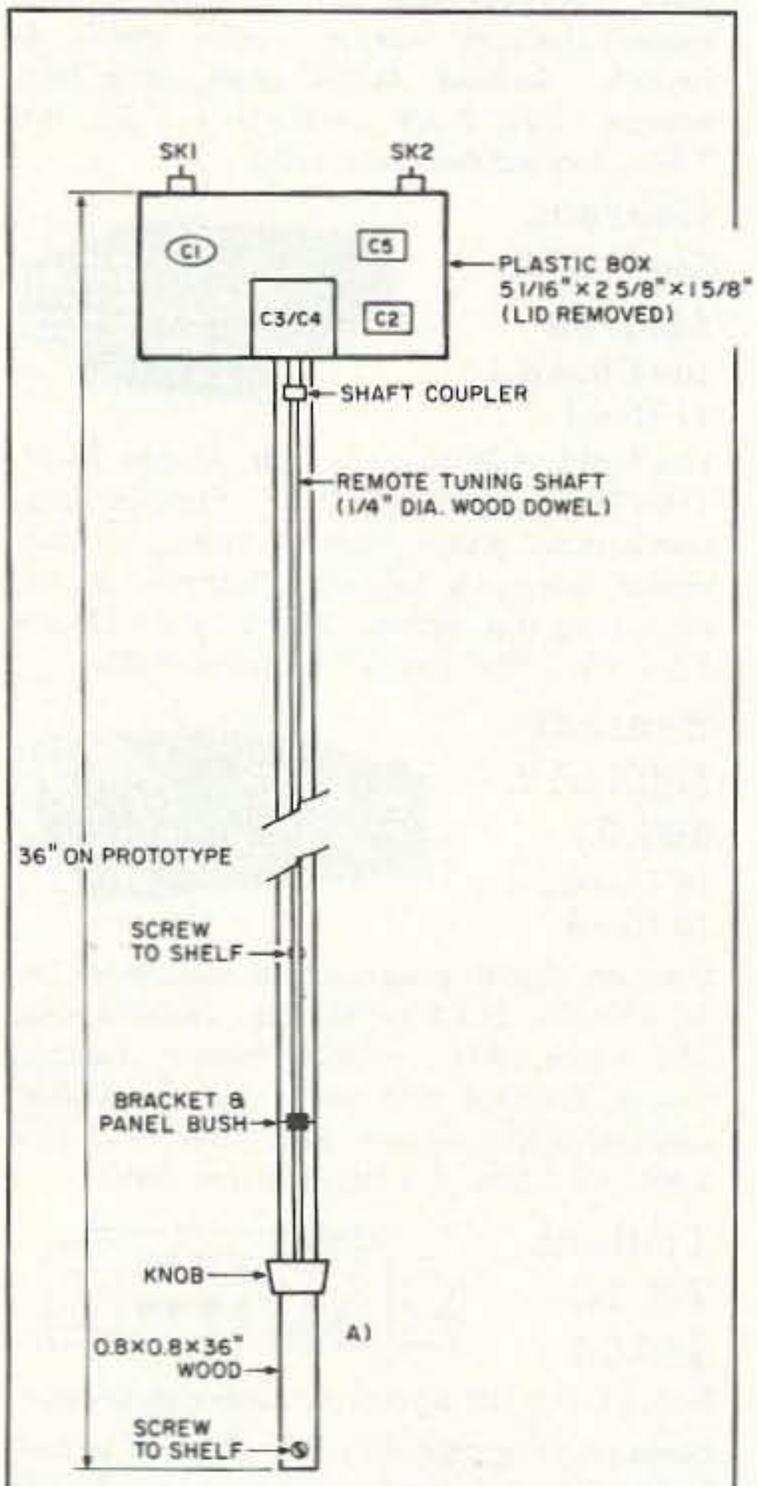

Figure 3. a) Tuning unit (with remote tuning shaft). b) Configuration used on the prototype.

Parts List

C3, C4	210 + 210 pF	2-gang variable capacitor with integral 3:1 reduction drive
C2, C5	33 pF 750 volt	Silver mica capacitor (see text)
C1	150 pF 1 kV	Ceramic disc
Loop	A+B*C is 42 feet of white #20 PVC covered stranded wire (larger diameter wire is advisable for outdoor installations.).	
PL1/PL2	4mm	Banana plugs
SK1/SK2	4mm	Banana sockets
Box	Plastic box 5-1/16" x 2-5/8" x 1-5/8" Tandy (Radio Shack), (120 x 65 x 40 mm), Cat. No. 270-233 Metal lid replaced (see text)	
Feedline	RG58 coaxial	Approx. 60" used
Tuning	1/4" (6mm) wood dowel to required length	
Shaft	(36" used on prototype) + shaft coupler + bracket and panel bush and knob	

bad. It was immediately answered by a station about 1,000 miles away. Though his signal was very weak, he gave an excellent report. Subsequent operating results were quite excellent between 0300 and 0500, several mornings per week.

Let me stress that this Loop, as described, is a low-power antenna for indoor use. *High power, indoors, can be dangerous and may be lethal.* If the Loop is erected outdoors, then higher power can be used. The wire gauge should be increased, and possibly higher voltage rating capacitors should be used.

Ideas

The results obtained with the configurations shown in Figures 1 and 2 indicate that the high voltage points are on Loop arm A; B and C give maximum radiation. It is well worth trying a reversal of PL1 and 2 in SK 1 and 2.

During experiments I tried a compressed version of the Compact-A-Loop (see Figure 4). The effective area taken up by the Loop was reduced by about 20/25%. Various angles were tried (AB) from 45 to 70 degrees. The usable bandwidth was about +/-15 kHz and an extra 15 pF was added to C2 and C5. This was still a very usable antenna.

I didn't try this Loop on other bands, but you would have little difficulty in adapting the design for this purpose.

Conclusion

This Loop antenna is a very useful, efficient, low-power device for the TXer with restricted space who wants to work on the 80 meter band. It is low cost, quick to erect, and has very obvious potential for the experimenter. It has given excellent results with no measurable harmonic radiation and no TVI on a TV receiver very near. 73