The Army Loop in Ham Communication

Tests in Comparison with Other Antenna Types

BY LEWIS G. McCOY,* W1ICP

A recent article in *Electronics*[1] described a military antenna that has created considerable interest in amateur circles, both in on-the-air comments and in mail to Headquarters. The antenna, a vertical loop designed for use in the 2.5- to 5-Mc. range, is said to have very high efficiency for its small size. The antenna is in the form of an octagon with five-foot sides, and is approximately 12 feet in width. In normal operation the antenna is set up with the base four feet above the ground, making the top about 16 feet high.

The antenna was designed for quick portability for use in Vietnam. The aim was to design an antenna that could be quickly dismantled or assembled, would pack into a small space, and would be an efficient performer. It was stated in the article that the antenna performed as well, or better than, a full-size dipole 40 feet in the air. No wonder amateurs are interested!

The photographs show our version of the antenna, built up to see how well it would perform in tests against various 80-meter antennas. Figs. 1A and 1B show the schematic of the antenna and matching network.

In any antenna that is physically small for the frequency, the radiation resistance will also be smaller than a full-size antenna. As the antenna is reduced in size, the radiation resistance also gets smaller and smaller. According to the formulas for small loop antennas, the radiation resistance of this loop is on the order of 0.5 ohm or less. In order for such an antenna to work at reasonable efficiency, the ohmic losses must be kept as low as possible. This means large conductors, low resistance joints and connections, and any other precautions that can be employed to reduce ohmic resistance.

In our model, 1½-inch-diameter aluminum tubing, the same as in the military version, was used for the loop. For connections at the joints, the tubing was flattened, filed smooth, and the pieces then bolted together at each joint with three ¼-inch-diameter aluminum nuts and bolts, as in Fig. 3.

In order to reduce losses, the military antenna used the matching circuit shown at Fig. 1B. This is a completely capacitive network; a network with inductances would have added to the

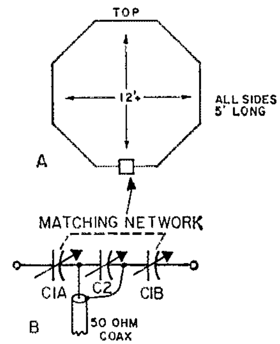

Fig. 1—A—Drawing of the octagonal loop; B—The matching network. In matching, a 50-ohm s.w.r. bridge is inserted in the coaxial line and the network adjusted to a 1-to-1 match.

C_{1A}, C_{1B}—Approximately 650 pf. per section, each section consisting of two 325 pf. variables in parallel.

C_2—Approximately 500 pf., two 250 pf. variables in parallel.

The interest aroused by a loop antenna described in Electronics *a few months ago sparked a trial by ARRL HQ of a home-built version. The proof of an antenna is in the communication it produces, so several commonly-used 80-meter antenna types were compared with the loop in direct A-B tests. Here is a report on the results.*

* Technical Department, *QST*.

[1] Patterson, "Down-to-Earth Army Antenna," *Electronics*, August 21, 1967.

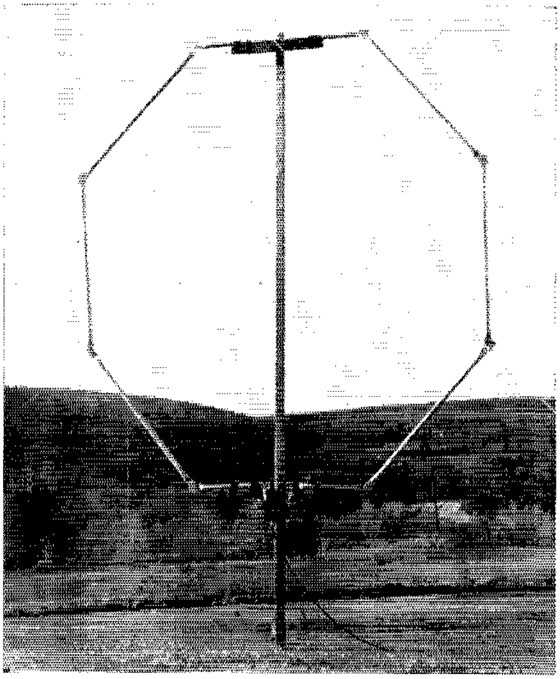

Fig. 2—The loop mounted on a guyed 2 x 3. The sides of the loop also were guyed as the antenna tended to be "floppy," in even light winds.

losses. Although a combination of fixed mica and air-spaced variable capacitors was used in the military version, it was discovered in our setup that the mica capacitors available to us heated up considerably at a power level of 150 watts. Air variables therefore were used throughout.

Testing the Loop

Our loop was set up exactly as described in the *Electronics* article, with the bottom four feet above ground. The antenna was matched to 50 ohms at 3980 kc. Three other antennas were used for comparison. The first was a full-size dipole, fed with 6-inch open-wire feeders, with the antenna about 60 feet in the air. The second antenna was an inverted V 100 feet long overall, center-fed with open-wire line. The top of the inverted V was deliberately installed at the same height as the top of the loop, 16 feet above ground, and the ends were brought down to four feet, the same as the bottom of the loop. One other antenna was used, a 30-foot high, base-loaded vertical, fed with 50-ohm coaxial line. All antennas were very carefully matched to 50 ohms at 3980 kc. A four-position coaxial switch was used so that switching could be accomplished instantly.

Several hundred tests were made, both listening and transmitting, over a four-week period. In no instance did the loop outperform the 60-foot high dipole. In listening tests the difference was of the order of three S units. This difference also showed up on transmitting — in fact, several stations accused us of turning on a linear when we switched to the dipole!

The difference between the loop and the inverted V was not so marked, but in most instances the V outperformed the loop by about one S unit. Usual transmitting reports were S6 on the loop, S7 on the V, and S9 or more on the big dipole.

The vertical produced some very interesting results. During the daytime the vertical was very poor compared to the other three antennas. In fact, in some instances, with S6 to S9 reports on the other three antennas, we weren't even heard on the vertical. However, after dark it was another story. Signal strength on the vertical came up to a par with the full-size dipole, actually surpassing it on some long-range (over 1000 miles) contacts.

Because the *Electronics* article had emphasized that the loop did a better job than a full-size dipole, we did considerable head scratching. Finally, we called Kenneth Patterson, designer of the loop, a call which brought forth some very interesting information. Mr. Patterson quickly pointed out that our problem was most likely in the ohmic losses in the joint connections. In the military version, special sleeve clamps are used over each joint to insure adequate "skin" contact. In addition, the joints are gold-plated! The gold plating reduces deterioration of the connection and provides excellent contact. This could very well be the difference between the performance of our unit and the military version.[2] Also, for the mica capacitors used in

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[2] The joint resistance could be eliminated entirely if a single section of tubing, of the same overall length, could be bent in a circle, since in the amateur case it would be unnecessary to provide for rapid assembly and disassembly.

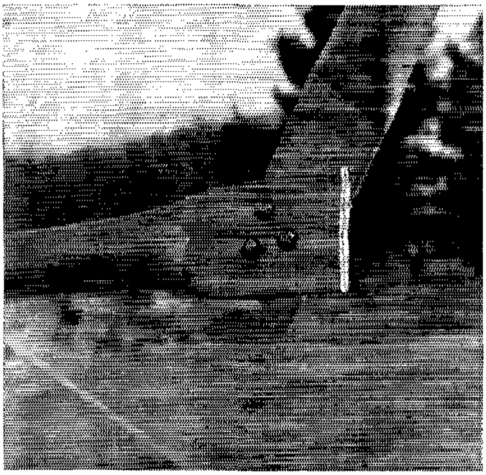

Fig. 3—This view shows the joint connections. In the military version, 45-degree elbows are used and the elbows and joints are gold plated.

M.U.F. Tendencies in Sunspot Cycle

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Elongated F_2 single hop (i.e., KH6 to eastern and midwestern USA, Europe to midwest and W5) usually occurs just as the skip is going out for the more regular F_2 distance contacts, such as KH6 to W6, or Europe to W1, 2, 3.

During the season change period (mid-March, mid-September) there are often F_2 type contacts between North and South America. The spring contacts often extend into late April or early May. Openings in March and early April are usually centered around 10 A.M. local time for the North American end. Later, our summer season E skip may yield a single hop of E skip into the Caribbean area, where it links up with the regular F_2 that builds up in the equatorial regions and south of the equator during our summer months. This may occur at any time of day, and contacts from 1600 PST to 1900 PST are not uncommon. Stations in the southern USA usually benefit the most from this.[3]

Summary

The low band occupancy during scattered 50-Mc. openings is a shame. There is no good reason why more of us can't be aware that the band is open, or that it is likely to be open, when these unusual conditions occur. This is especially characteristic of regions of the Caribbean, Central America and northern South America. In this regard, we can all stand to do a little missionary work.

I am reminded of an instance on January 3 when W6BJI here in Fresno heard VP1PV in Belize, British Honduras on 10 meters asking a VE3, . . . "hey, what's going on with 6 meters?" WB6BJI broke in and told the VP1 in short order. That was a Wednesday, and the VP1 promised to be on 6 the next Saturday, the 6th. (He had a converter, but had to build a transmitter and beam!) On the 6th, he was on the air, and promptly worked into W/K.

50 Mc. is often open; at least much more often than we observe with reportable two-way contacts or verifiable heard reports. But you do have to be on hand at the right times, and so does somebody else, at the right distance, in the right direction! QST

[3] Similar combinations of east-west F_2 and the north-south TE mode have provided extreme DX, even to more than half way around the world. — *Editor*

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the military version, Mr. Patterson stated that the military have access to a higher-quality mica capacitor than the average ham, and we have to agree! The loop has been used for over two years in Vietnam with excellent results reported, and because of the inherently high angle of radiation from such an antenna, it is particularly useful in maintaining contact from gullies or ravines where normal whip operation would be impractical.

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Conclusions

For a ham with limited real estate, the antenna has possibilities. However, cost is an important factor when all the considerations are taken into account. The version shown in the photographs cost about $70.00. The 1½-inch-diameter tubing was about $35.00 and the air variables in the matching network about another $30.00. A considerable amount of capacitance is required; C_1 is about 650 pf. for each section and C_2 amounts to about 500 pf. If surplus variables with necessary capacitance could be found, the total cost could be reduced. However, a wire dipole will do as good a job or better, is much cheaper, and can be used on all bands. The loop, because of its small physical size and low resistance, is inherently a narrow-band antenna. It maintained a reasonable match about 10 kc. either side of the match point, but any frequency change greater than this would require rematching. This isn't true of a center-fed dipole with tuned feeders. QST

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at the judges' booth. Mobile stations trailed the foot runners and reported the progress of the race. — *K3NYG.*

On Dec. 17, Ulysses, Kansas, was selected as the site for a simulated commercial power failure. This particular area would also be without its telephone system, which depends upon commercial power. WAØNFP moved his station to a hospital and operated on 75 meters using a temporary vertical antenna and a portable generator. Over 25 stations checked into the Zone 11 Kansas AREC Net and all were able to hear WAØNFP. During the test, a 2-meter link was available from Dodge City to Minneola, Copeland and Montezuma. The test was a success. — *KØJDD, EC Zone 11, Kansas.*

Forty-five SEC reports were received for the month of Nov., representing 16,833 AREC members. This is two more reports but 301 fewer members than for a year ago. The following sections reported: Ala, Alta, Ark, BC, Colo, Conn, Del, EFla, EMass, Ga, Ill, Ind, Kans, Ky, La, Me, Mar, MDC, Mich, Mo, Mont, Nebr, Nev, NH, NLI, NC, NNJ, Okla, Ont, Org, Que, SF, SCV, Sask, SDak, SNJ, STex, Tenn, Utah, Va, Wash, WVa, WFla, WNY, WPa. QST

How's DX?

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usually get on around 28,560 kc. from 2200 GMT till the band closes, then start up on 14,250 kc. at 0200 or so, week ends only." Traffic work takes precedence over DX hunting at KG6IC, and Don notes that his QSOs with Sixes outnumber any other U.S. call area at least two to one ._._._ KH6BZF reports action by 5W1AS on 28,582 kc. at 0230 GMT or so, also that WA6VOP/KH6 changed his spots to KH6GKI ._._._ ZL2AFZ tells WA1DJG of imminent Chathams hamming, and WA6VVJ solicits your cooperation to assist with plans for a Brunei go ._._._ K6CAA totes a KWM-2, HW-32A and 18-AVQ with him to KP6AP and other Pacific points ._._._ More Oceanian tidbits from literature of aforementioned clubs and groups: VKØIA supplants VKØCR on Macquarie, 14,030-kc. c.w. after 1500 GMT, the latter returning to VK3UG. . . . VK9DR's departure leaves Christmas in VK9XI's 20-sideband charge. . . . Ex-ZK1AR rocks 'em as 5W1AT. . . . PKs 1SH 8YAK 8YBC 8YFE and 8YZZ abound on 20 phone, 1000–1300 GMT.

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