What's the Scoop on the Lazy Loop?

Here's how multiband wire antennas measured up in real-world comparisons.

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Twenty years ago, I installed my first 80-meter full-wave horizontal loop antenna, called "The German Quad" by DF3TJ in his article (*73 Magazine*, June 1978). Since that time, I have continuously used this type of antenna as a standard of comparison for all other antennas used at my QTH. Although several construction and computer analysis articles have been written about full-wave horizontal loop antennas, there has never been an article in which the real-world performance of these antennas was compared to other wire antennas. In this article, I will try to share what I've gleaned from my many years of antenna experience.

For the record, my QTH is located in northern New Jersey, and is approximately 300 feet above sea level. My square, coax-fed, 80-meter loop is located approximately 40 feet above the ground. I also have a pentagonal 160-meter full-wave loop, fed with 450-ohm open-wire, at approximately 60 feet of elevation.

I have used my horizontal loop antennas for many years, enjoying thousands of contacts with amateurs who used a large variety of antennas, and have had hundreds of in-depth discussions with other hams who use loop antennas. Both of my loop antennas are solid performers on their fundamental frequency, and the 80-meter version provides excellent performance on eight amateur bands (10–80 meters).

I am a casual DXer and an avid ragchewer, and my two loops have helped me to earn WAS and WAC on all HF bands. I also have more than 100 countries confirmed on each of six HF bands, and over 60 countries on each of the rest. One highlight on 160 meters was an "S-7" from a VK5, in southern Australia, 10,000 miles from my QTH. He reported that my "cloud warmer" was giving him the only signal he could hear well enough to work at that time.

The following advantages have been noted by most users of horizontal-loop antennas:

•Better than average performance on all HF and SWL bands.

•Simple, low-cost installation which does not require traps, baluns, or tuning and pruning. Just install it according to the measurements in **Table 1**.

•The antennas are inconspicuous, and provide good performance at lower heights than most other wire antennas.

•SWR of less than 3:1 (see **Fig. 1**) at some point in every HF band, allowing the built-in automatic antenna tuners in most new HF rigs to provide a proper power transfer to the antenna.

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Band	Length of Each Side	Total Length of Wire	Minimum Height Above Ground
40 m	35 feet	140 feet	20 feet
80 m	70 feet	280 feet	40 feet
160 m	135 feet	540 feet	60 feet

Table 1. *Construction details for full-wave multiband horizontal loops.*

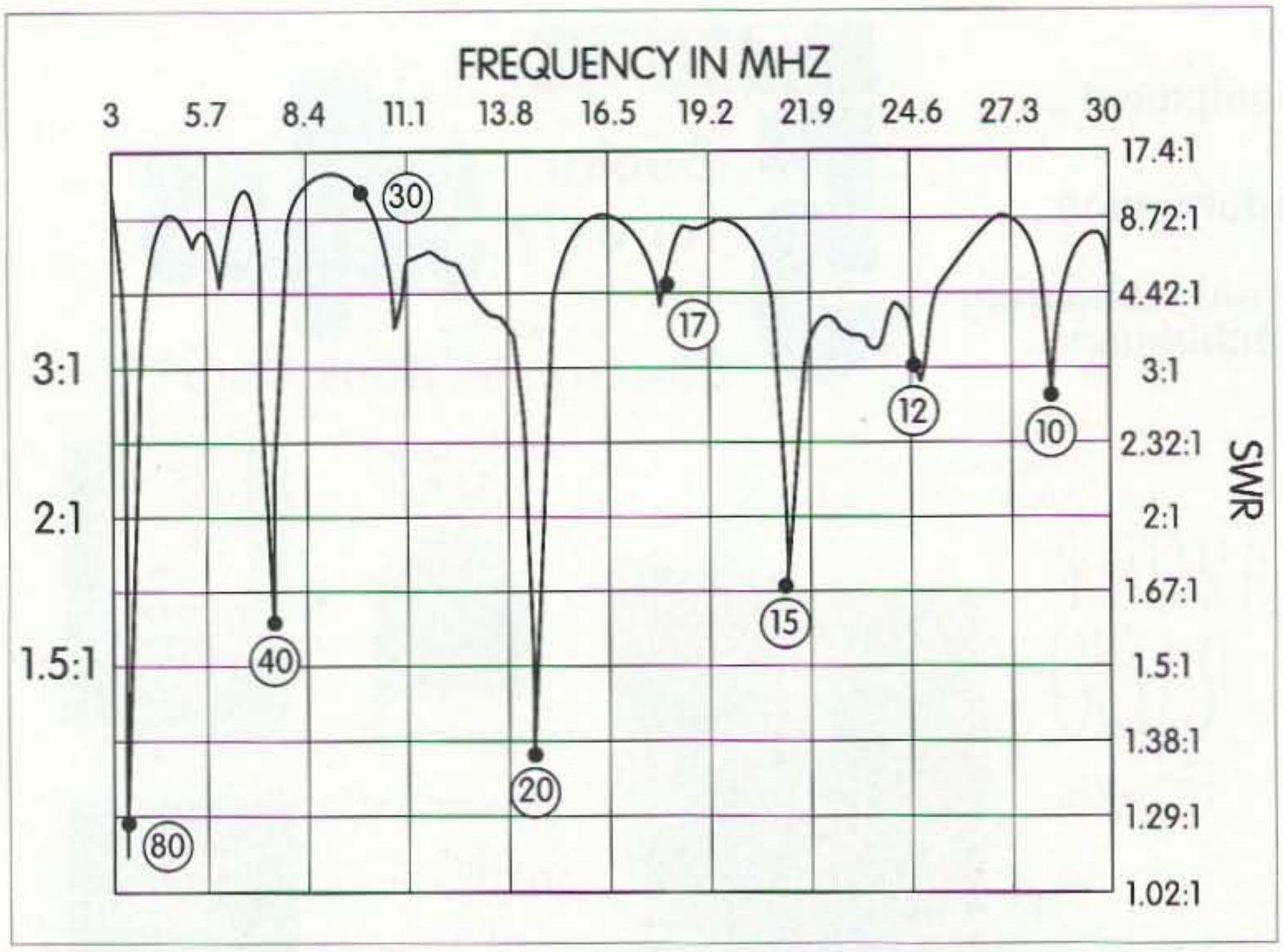

Fig. 1. *All bands chart. Relative SWR vs. frequency for the 80 m loop, as measured with a Hewlett-Packard 3577A Network Analyzer.*

•Some noise cancellation, due to the closed-loop design, when compared with open-ended type antennas.

•High-Q with low feedpoint impedance (20 to 200 ohms) and good bandwidth.

•Large capture area with less QSB or fading.

•High efficiency with 3- to 18-dB apparent gain over other simple wire antennas.

There are few disadvantages, and these are usually related to the individual preferences of the owner or the physical constraints created by his location. The disadvantages most often mentioned are:

•Large size (up to 140 feet per side, and 200 feet diagonally, for the 160-meter version).

•The need for four conveniently-placed tall supports.

•Some sort of inline tuner is necessary.

•The radiation pattern is more or less omnidirectional.

About a decade ago, I gave an antenna lecture at a local radio club. During the question-and-answer phase, I was given a friendly challenge to prove my statement that an 80-meter horizontal loop provided good DX performance on the 75-meter phone band. That challenge lead to a series of real-world comparisons of loops, single- and multiband wire antennas, and a couple of beams. I hope that reporting these actual results will dispel the commonly-accepted myth that horizontal loop antennas, at their fundamental frequencies, are cloud warmers useful only for local contacts.

Several local hams agreed to join in the antenna tests. During the first test, we were all located within five miles of each other, each had his antenna in the clear, and our elevations were all between 200 and 300 feet above sea level. To keep the results as fair as possible, we all agreed to use a power level of only 100 watts. My antenna was the 80-meter loop at a height of about 40 feet above the ground, test antenna #1 was a 75-meter dipole at 60 feet above the ground, and test antenna #2 was a 75-meter inverted vee at approximately the same height.

Our first contacts were with hams located 75 to 100 miles from Park Ridge (New Jersey). We found the loop to have as much as a 40 dB advantage over the dipole and inverted vee, proving that the loop certainly does have considerable high-angle radiation. Next, a group of five hams scattered around the Midwest volunteered to help in our tests.

Rank	Antenna Type (mounted at 40 feet)	Performance Characteristics:			
		Ground Wave	Short Skip	Long Skip	Short Term Fade
1	Full Wave 80 m Horizontal Loop	fair	excellent	good–excellent	very good
2	Centerfed Zepp	poor	very good	fair–good	poor
3	Inverted "L" (130 feet long)	good	good	fair	good
4	Windom	fair	very good	fair	poor
5	Multiband Trap Dipole	poor	very good	fair	poor
6	G5RV	poor	good	poor	poor
*	2-Element Multiband Quad	very good	good	excellent	very good
*	Trap-Type Triband Yagi	good	fair	good–excellent	fair
*	Half Wave Vertical	excellent	fair–good	good	poor

Table 2. *Wire antennas, ranked by all-around performance. (*) indicates the antenna referred to is not a wire antenna; used for comparison only.*

The transmitted signals from the loop averaged one and a half S-units better than the other antennas. On that static-prone night, my receive capability was Q-5, while my friends were having some trouble copying the Midwest stations through the static crashes. West Coast stations who had been following the test from a distance of approximately 3,000 miles agreed that the signal from the loop had a one S-unit advantage over the dipole and inverted vee.

We then turned our attention to Europe and beyond, working stations up to 5,000 miles away. We contacted hams in several different countries, in an attempt to eliminate any advantages in directivity one antenna may have had over another. The loop still exhibited at least a 3 dB advantage over the dipole and inverted vee, and in some cases was up to one S-unit better, according to the stations we worked.

The evening ended with a discussion on two-meter FM, as we analyzed the results of our tests. We all agreed that the 80-meter loop was the clear-cut winner and had a distinct edge over the dipole and the inverted vee at all distances. Since that time, one of the testers has installed his own 80-meter loop and has achieved similar results when comparing the loop and the inverted vee at his home.

The results on 75 meters prompted me to think that we should expand our testing to include all HF bands and many of the popular multiband wire antennas. Approximately five years ago, I organized several members of the State Line Radio Club of New York and New Jersey to help with the testing program. We spent several months of our spare time on this project, and in the process made hundreds of SSB contacts on all HF bands, at all times of the day and night, with stations both near and far.

We tried to eliminate the effects of QSB by having each station make several short transmissions of its callsign, repeating the process until the receiving station was certain that it could rank each antenna type against the others. Many times stations who were listening to our tests would break in with

reports from other areas, and we would record their results as well. We felt that accepting all reports from any area would help equalize any directivity exhibited by any of the antennas in our test group.

After several weeks of testing, certain patterns began to emerge from the accumulated data. We were quite surprised to discover that some types of antennas performed better than we would have anticipated and some performed more poorly. In some cases, we repeated the tests when two or three antennas appeared to be nearly equal in performance, so that we were able to definitively rate the antennas. Some other hams who joined our test program had quads, yagis, or vertical antennas, and their results were included for comparison to the multiband wire antennas.

As the tests came to a close months later, we were excited to sift through the many reports and come up with our rankings. **Tables 2** and **3** show the results of our real-world tests. Please remember that the wire antennas and beams used in our tests were average antennas erected by average hams.

Of the multiband wire antennas, the 80-meter horizontal loop was the best all-around performer. In fact, not one of the other multiband wire antennas outperformed the loop on any band or at any distance. At times, one or another of the antennas would equal the loop in performance, but not on a consistent basis. As you can see, each antenna had its shortcomings, and some of the more widely-publicized antennas do not even come close to meeting their reputations.

Our on-the-air testing has allowed me to offer the following tips if you want to install your own horizontal loop antenna:

•A four-sided quad provides better multiband harmonic performance than a three-sided delta. Rectangles or pentagons also work well.

•The loop seems to work better when corner-fed with 75-ohm coax instead of 50-ohm coax. (Varying the feedline length may improve multiband matching.)

•A multi-turn coaxial-coil RF choke placed at the feedpoint of the antenna works well to keep RF off the shield.

•450-ohm open-wire used as a feedline for the 160-meter loop provided dramatically improved performance over coax when this antenna was used on 20 meters and higher.

•Higher is not necessarily always better, but the loop should be at least 1/8-wave above ground on the fundamental frequency.

One final test may be of interest. A fellow club member purchased and installed a new 70-foot tower and one of the better-rated linear-loaded triband beams following our initial tests. His old trap tribander on a 50-foot tower had been outperformed by my loop on several occasions, and he was looking

Antenna Type (40–50 feet above ground)	Cost	Radiation Pattern	Feed Line	Optimum Results	Tuning Requirements	Notes
Full Wave 80 m Horizontal Loop	Low	Many lobes and nulls on higher bands	Coax or open line	10–80 m; very broad-banded	T-match with balun	Needs 4 supports. Excellent low-noise antenna, including SWL.
Centerfed Zepp	Low	Varies with band	Open wire	On several bands	Balanced-wire tuner	Classic multiband antenna. Used over 60 years.
Inverted "L"	Low	Varied lobes and nulls	Coax	Only on a few bands	Wide-range tuner	Quite directional on higher bands.
Windom	Low	Varied lobes and nulls	Open wire or coax and special balun	Only on a few bands	Wide-range tuner	On some bands, open-wire portion is part of antenna.
Multiband Trap Dipole	Low to Medium	Bidirectional	Balun or coax	On several bands, when mounted high above the ground	None, if properly made	The old standard. Fair for DX.
G5RV	Low	Varies with band	450-Ω wire line to balun and coax	On resonant band	T-match	Compromise antenna, poor for DX.
2-Element Multiband Quad	Medium to High	One main lobe	Coax	On a maximum of 5 resonant bands	Built-in match at antenna	Needs tower and rotator. Height not as critical as with yagi.
Trap-Type Triband Yagi	High	One main lobe	Coax	On resonant bands; 10 m, 15 m, 20 m	Built-in match at antenna	Needs tower and rotator. Higher is better.
Half Wave Vertical	Medium	Omnidirectional	Coax	10–20 m	Built-in match at antenna	Good for limited-space applications.

Table 3. *Results of antenna comparisons.*

for revenge! As we scouted the 20-meter phone band, we located a Tasmania (VK) station who was willing to compare our signals, and as we started testing, a local "Big Gun" asked to join the test. We agreed, thinking that his participation would provide for more interesting results. The Big Gun was definitely a Big Gun superstation. He had stacked monobanders on a 110-foot tower and a three-tube Alpha capable of 3 kW!

The first report from the VK showed that the kilowatt-fed tribander and the 80-meter loop were S-6, and the Big Gun was S-9 in Tasmania. When the Big Gun turned off his Alpha, we were all S-6! Now, who do you think got the most satisfaction from these reports? My friend with the new $1,200 tower and tribander, the Big Gun with his $10,000 antenna system, or me with my $20 horizontal loop?

You may disagree, but after 20 years of general hamming, DXing, and occasional contesting, I am extremely satisfied to have accomplished so much with such a minimal investment. My 80-meter horizontal loop antenna consistently outperforms all other simple multiband wire antennas and usually holds its own on the higher bands when compared with ordinary yagis installed at ordinary heights. If you decide to try one, you will not be disappointed!

As a final note, I would like to thank all the local and worldwide hams who have made this article possible through their patience and enthusiasm for our antenna testing project. 73