Four Bands on a Bamboo Pole

— try a Chinese vertical slanter on 10 through 40

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Many of us hams like to work DX. My friend, Harry, who lives down the street, had worked many DX stations. I had worked no DX at all! I asked Harry what I could do to work DX.

"Get a long, bamboo fishpole and build a vertical J like mine," he replied. "Get the bottom of the antenna higher than the electric light wires. Get the thing resonant, and you'll work across the big pond."

Harry was my "consulting engineer," and taking his advice usually brought good results. I purchased a 23-foot bamboo fishpole and mounted it high on the house using some lightweight 1 by 2 lumber. A vertical J antenna was suspended from the top of the fishpole. The matching stub was tuned to frequency, and the 600-Ohm open-wire feedline was attached and adjusted for the best transfer of rf energy into the antenna system. As usual, Harry was right. I got a big thrill the next day when I worked my first European station!

Seeing the big bamboo fishpole, one of my friends called it a "Chinese antenna." When I mentioned this to Harry, he laughed and remarked, "Maybe we can shanghai some DX." Since that time, bamboo fishpoles have been used in most of my vertical antennas, and the "shanghaiing" has been very good. (Fiberglass fishpoles 20 feet long also work well in antenna construction, but they are more expensive and are hard to find.)

This article will present information from some books and a magazine article and explain how this information was applied in making a four-band "Chinese vertical slanter" antenna system that is the best non-beam DX antenna that I have ever used.

In the December, 1978, *73 Magazine*, antenna axioms were presented.[1] Among these were: (1) The antenna system should be resonant at the frequency being used. (2) The rf from the antenna must be effectively put into the antenna. (3) There is no substitute for height; the higher the antenna, the better. (4) At easy-to-attain heights, vertical antennas have lower angles of radiation than do horizontal antennas. This makes them good for DX.

Because of their lower angles of radiation, vertical antennas have been known to outperform horizontal beams in making DX contacts, especially in cases where the horizontal beam was not any higher off the ground than the center of the vertical antenna. The value of low-angle radiation in working DX is beautifully explained in Capt. Paul Lee's book in Chapter 1, "Optimum Design For DX."[2] This chapter also contains other valuable information useful to antenna designers.

Vertical antennas longer than a quarter wavelength radiate rf at lower angles to the horizon than do quarter-wavelength ground-plane antennas. The angles of a quarter-wavelength ground-plane antenna are from 10 to 55 degrees. For a 3/8-wavelength vertical antenna, the angles are from 8 to 40 degrees. A half-wavelength vertical's angles are from 5 to 35 degrees. The angles of a 5/8-wavelength vertical are from 3 to 27 degrees.[2] For 3/4-wavelength verticals, "there is some slight deterioration of the low angle vertical pattern, but this is not serious."[3]

Vertical antennas longer

than a quarter wavelength also have power gain as compared with a quarter-wavelength ground-plane antenna.[4] A half-wavelength vertical antenna has a power gain of 1.8 dB as compared with a quarter-wavelength ground-plane antenna. A 5/8-wavelength vertical antenna has a power gain of 3 dB as compared with a quarter-wavelength ground-plane antenna. One can surmise also that a 3/4-wavelength antenna has some power gain as compared with the ground-plane antenna.

From this information, it is clear that vertical antenna lengths between 1/4 and 3/4 wavelengths will be better for making DX contacts than the popular coax-fed ground-plane antenna. To use these ideas in a multiband vertical antenna, tuned feeders must be used to take the rf from the transmitter to the radiating wires. When tuned feeders are used, balanced antennas can be built with wires almost any length, provided that *the length each side of the tuned feeders is the same.* Furthermore, such an antenna can be "loaded up" and used on several bands.

My friend Harry was somewhat impressed with this information. He suggested, "Why don't you make a chart comparing a tuned-feeder vertical with the popular trap vertical that is about 22 feet tall? After you get that one figured out, figure out what length of wires would make the best all-around DX antenna for 40, 20, 15, and 10 meters."

My "figuring" was as follows. For all practical purposes, the trap vertical is a quarter-wavelength ground-plane antenna on all bands, with the highest frequency radiators closest to the ground. As such, the angles of radiation with respect to the horizon are from 10 to 55 degrees on all bands. Except for the 40-meter band, on which all 21½ feet radiate, the trap vertical does not have its radiating antennas as high in the air as does a 22-foot "vertical slanter." (Axiom No. 3: "There is no substitute for height.")

With the vertical slanter, all 22 feet radiate on all bands. With respect to power gain and angles of radiation, the vertical slanter has the following as compared with the ¼-wavelength ground-plane antenna with its 10 to 55 degrees angles of radiation on all bands: On 10 meters, the vertical element is 5/8 wavelengths with a gain of 3 dB and angles of 3 to 27 degrees. On 15 meters, the vertical element is 1/2 wavelength with a gain of 1.8 dB and angles of 5 to 35 degrees. On 20 meters, the vertical element is a bit shorter than 3/8 wavelength, would have some gain as compared with the trap vertical, and the angles of radiation would be somewhat lower than those of the trap vertical.

With a ground-plane antenna using 4 equally-spaced radials, the radials do not radiate because the fields of the radials cancel out each other. Drooping the radials increases the gain of the ground-plane antenna.[5] Therefore, it is logical that a vertical-slanter tuned doublet, or a one-radial tuned ground-plane antenna might have some gain compared with a quarter-wavelength ground-plane antenna because there are no other radials to cancel radiation from the lower half of the antenna.[6]

Another great advantage of a vertical-slanter tuned doublet is that it can be tuned to exact resonance at any frequency, phone or CW, on any band, 10, 15, 20, or 40 meters. This means that the antenna will load up equally well on phone and CW in all of

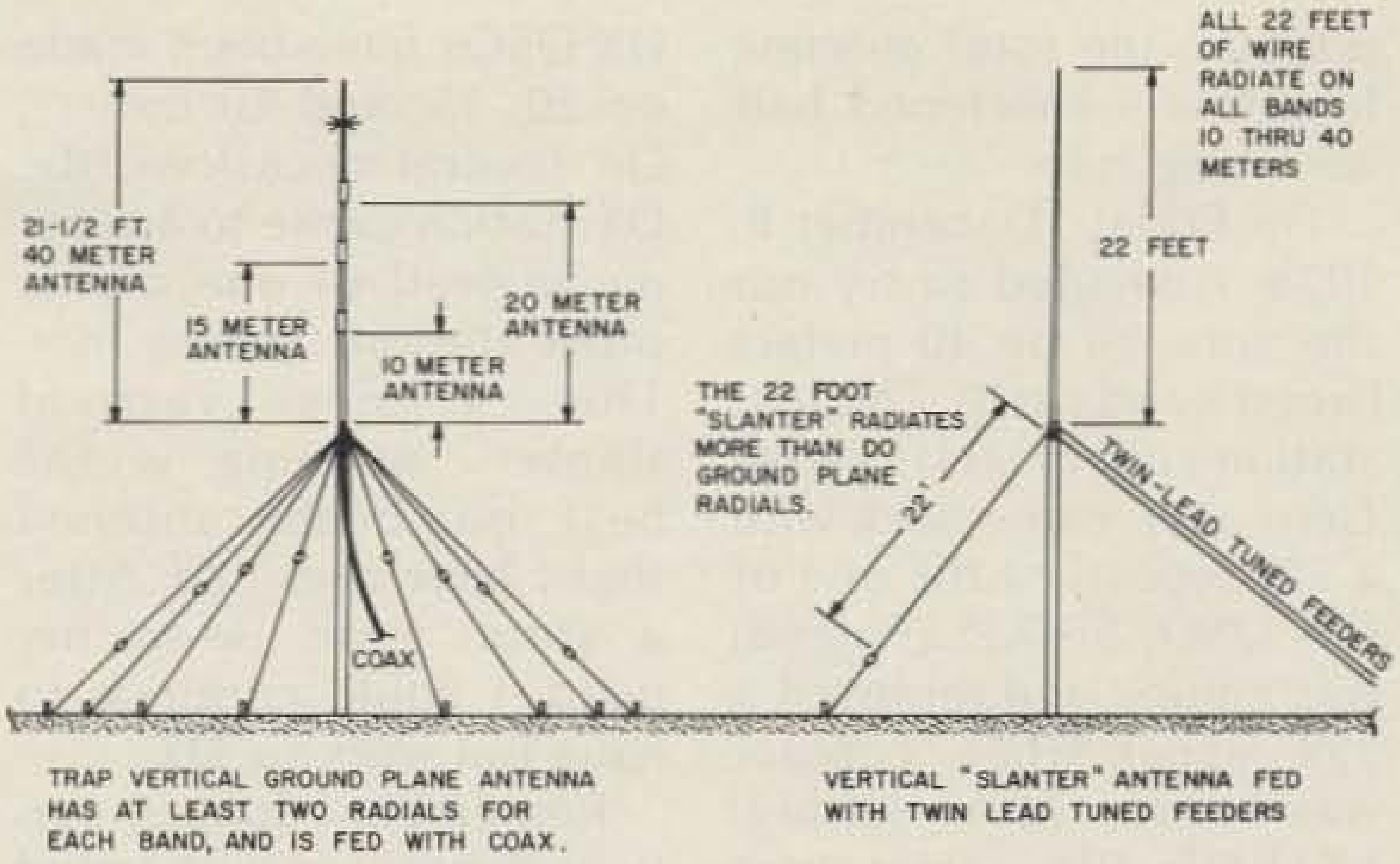

Fig. 1. Typical trap vertical and "vertical-slanter" four-band antenna fed with tuned feeders. The bottom of each vertical element is 20 feet above the ground.

these bands.

Harry made this suggestion: "When you figure the best wire lengths for your four-band DX vertical slanter, make the wires as long as you can without degrading the performance on 10 meters. Of course, if you want better performance on 40 and 20 meters and don't care about 10 meters, you could make your wires as long as possible without degrading the 15-meter performance."

With this in mind, I chose 26 feet as the wire-length for the best performance on 10, 15, 20, and 40 meters. Twenty-six feet is 3/4 wavelength for 10 meters. If I did not care to work 10 meters, I would have chosen 33 feet, 3/4 wavelength for 15 meters.

The gain and angles of radiation for the 26-foot wire vertical-slanter antenna are conservatively stated as follows: 10 meters (3/4 wavelength), "guesstimated" 2.5 dB, with angles 5 to 35 degrees; 15 meters (5/8 wavelength), 3 dB, with angles 3 to 27 degrees; 20 meters (.39 wavelength), "guesstimated" 1.4 dB, with angles somewhat less than the 10-50 degrees of a quarter-wavelength ground-plane antenna. On 40 meters, 26-foot-long wires would work better than 22-foot-long wires.

Since in theory a vertical-slanter antenna fed with tuned feeders seemed to be much better than a four-band trap vertical, I decided to build one and try it out. I had an old, used piece of no. 12 Romex, 25′ 8″ long. This was very close to 26 feet, so I took out the two wires and used them in the antenna. A bicycle whip taped to a bamboo fish-pole clamped to a small sailboat mast supported by two 8′ two-by-fours clamped to a fence post was used to support the vertical part of the antenna. The black wire was taped to the supporting structure as the vertical element. (The black color helped to absorb heat and melt the ice after an ice storm.) The white wire was used as the slanter which was drooped down and out towards the south. 300-Ohm twinlead was used for the tuned feedline. The "Chinese vertical slanter" antenna looked interesting, but would it really work?

I thought that 40 meters would be the band on which the antenna would be least effective. (If thought of as a one-radial tuned ground-plane antenna, the vertical element is less than a quarter wavelength long. If thought of as a center-fed tuned doublet, the total antenna length is a shortened half wavelength.)

On Friday, December 8, 1978, I decided to try out the antenna on 40 meters (worst band first!). The first station called, DJ4IT (West Germany), came back with a 579 report. At the end of this QSO, SP7EJS (Poland) was calling and reported a 559 signal when contact was made. After supper, LZ1KUF (Bulgaria) was called, but he did not come back. (I was not sure whether or not he had called CQ.) The next two calls resulted in QSOs. DL7PR (West Germany) reported 569, and YU1QFX (Yugoslavia) reported 599. (I suspect that this report was exaggerated for the sake of international goodwill. Hi!) These QSOs convinced me that the antenna worked well on 40 meters. Since that time, with very little time on the air, many DX QSOs have been made on 20, 15, and 10 meters. On several occasions, the DX station chose to answer me instead of one of the other stations calling him. This "Chinese vertical slanter" antenna is the best non-beam antenna that I have ever had. After a storm took down my quad, I could continue to have fun working DX.

Remember that a vertical slanter fed with tuned feeders will load up equally well on both CW and phone frequencies. The above-described antenna even loaded up and made a few contacts on 80 meters. However, the wires are much too short for good performance on the 80-meter band.

For even better performance, a system of radials each about 35 feet long, buried in the ground, could be added to the antenna system. The center of the radials should be under the vertical element. The more radials, the better. However, the antenna works well without radials as the above information indicates.

I have no trap vertical with which to compare the "Chinese vertical slanter" using on-the-air contacts. Certainly DX can be worked using trap verticals and other coax-fed groundplane antennas. However, antennas with more gain, lower angles of radiation, and more effective feed systems will certainly outperform any comparable coax-fed groundplane antenna when it comes to making DX contacts.

I think you'll enjoy the "Chinese vertical slanter antenna." Build one, use it, and find out for yourself how good a non-beam antenna can be for working DX. ■

References

1. "Tuned Feeders and Other Good Stuff," William R. Stocking WØVM, *73 Magazine*, December, 1978, p. 118.

2. Capt. Paul H. Lee (USNR) K6TS, *The Amateur Radio Vertical Antenna Handbook*, p. 13.

3. Edward M. Noll, *73 Vertical, Beam, and Triangle Antennas*, p. 35.

4. William I. Orr W6SAI and Stuart D. Cowan W2LX, *Simple, Low-Cost Wire Antennas for Radio Amateurs*, p. 43.

5. William I. Orr W6SAI and Stuart D. Cowan W2LX, *The Radio Amateur Antenna Handbook*, pps. 88 and 92.

6. This idea does not take into consideration ground losses. It might be that four drooping radials, each the same length as the vertical element, would enhance the performance of the antenna because there would be less ground loss. Radials buried in the ground under the vertical-slanter antenna might improve its performance, and they are suggested near the end of the article.

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