An Extended Double Zepp Antenna for 12 Meters

Got a little over 50 feet of horizontal space to spare for a 24-MHz skywire? This simple antenna will beat your half-wave dipole by about 3 dB—and you can phase two of them for even more gain and directivity.

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According to *The ARRL Antenna Book*, *Zepp*—short for Zeppelin—is a term long applied to just about any resonant antenna end-fed by a two-wire transmission line.[1] A bit further on in the *Antenna Book*, there's a discussion of the extended double Zepp (EDZ) antenna.[2] This interested me because I have always been intrigued by "old-fashioned" wire antennas—and because the old-fashioned extended double Zepp's 3-dB gain over a half-wave dipole would provide performance quite suitable for *modern* times! The EDZ antenna consists of two collinear 0.64-λ elements fed in phase. Fig 1 shows current distribution in an EDZ, and Fig 2 shows the EDZ's horizontal directivity pattern in free space.

[1]Notes appear on page 27.

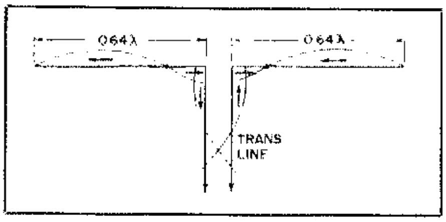

Fig 1—The extended double Zepp antenna consists of two 0.64-λ elements fed in phase.

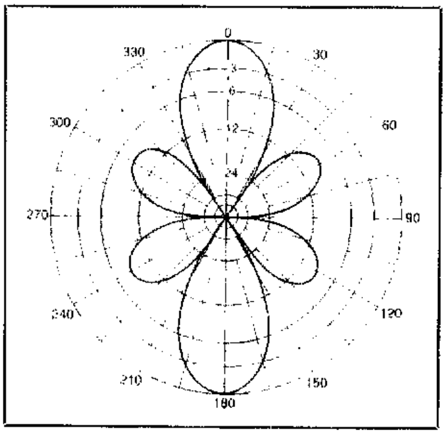

Fig 2—Horizontal directivity pattern for an extended double Zepp antenna in free space. Relative to a half-wave dipole, it exhibits a gain of approximately 3 dB. The antenna elements lie along the 90°-270° line.

The extended double Zepp's theoretical performance looked good to me, so I designed and built an EDZ antenna for the 12-meter band. Fig 3 shows its configuration. I decided to cut mine for 24.950 MHz. Each EDZ element is 25 feet, 3 inches long, and consists of no. 14 stranded copper wire. The antenna elements are center-fed by a short matching section made of a 5-foot, 5-inch length of 450-Ω open-wire line. Connection to 52-Ω coaxial feed line is made by means of a 1:1 balun transformer. My EDZ is strung between two trees, 35 feet above ground.

Matching Section

Perhaps I am "reinventing the wheel," but I have not seen this matching method

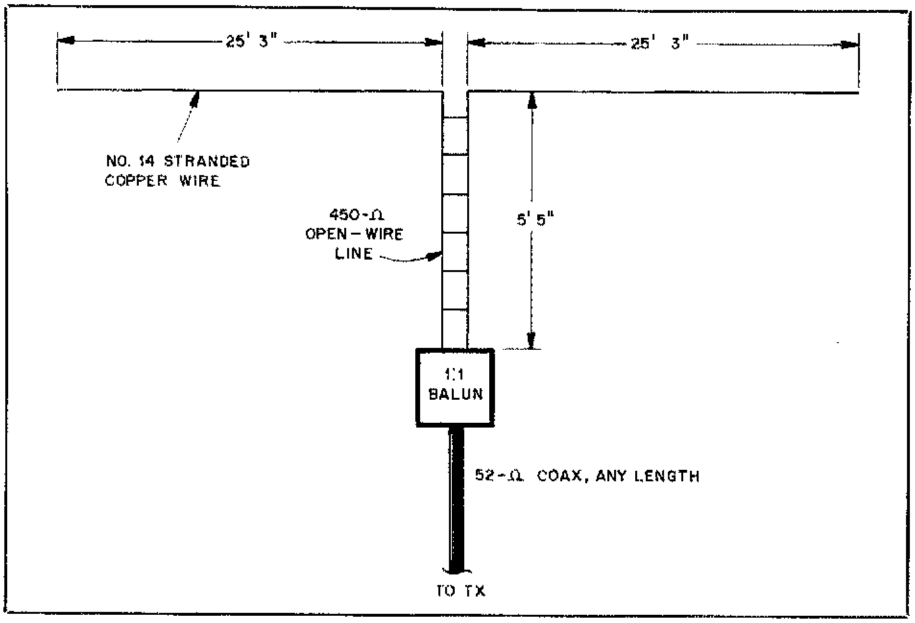

Fig 3—The extended double Zepp at K7KGP, cut for 24.950 MHz. The 450-Ω matching section transforms the EDZ's calculated input impedance (142-*j*555 Ω) to 55 Ω (measured) for connection to 52-Ω coaxial cable by means of a 1:1 balun. The electrical length of the matching section is 52°; the linear dimension shown in the drawing assumes 450-Ω line with a velocity factor of 0.95.

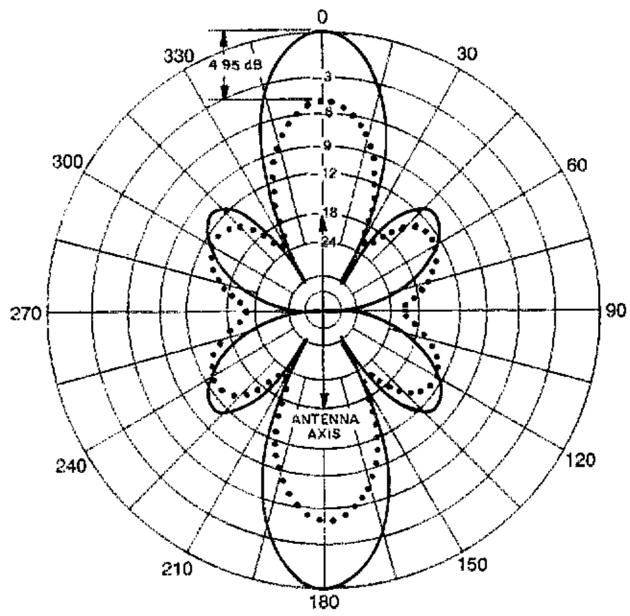

Fig 4—Comparison of calculated horizontal directivity patterns of one extended double Zepp (dotted line), and two EDZs spaced at 1/8 λ and fed 180° out of phase (solid line). The antenna axes lie along the 0°-180° line, and the antennas are mounted 35 feet above average earth. The phased EDZs exhibit nearly 5 dB gain over a single EDZ. This is 7 to 8 dB gain over a half-wave dipole. Beamwidth of the two-EDZ array is 30°. The antenna axis is the same for the single EDZ and both EDZs in the phased array. The two-EDZ configuration characterized here is an *end-fire* array because maximum radiation occurs along its axis.

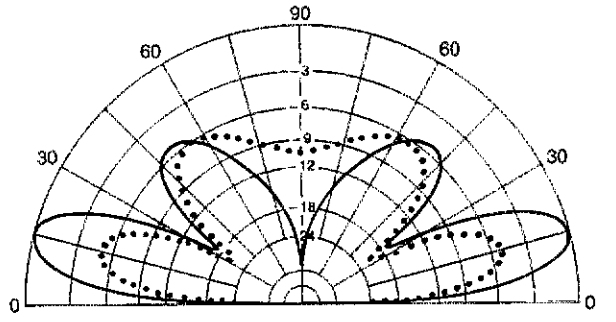

Fig 5—Comparison of the calculated vertical directivity patterns of one EDZ (dotted line), and two EDZs spaced at 1/8 λ and fed 180° out of phase (solid line). The antenna axis lies along the 0° line.

elsewhere.[3] The open-wire-line matching section is 52 electrical degrees long (0.145 λ). The matching section transforms the EDZ's input impedance to about 55 ohms, as measured with a noise bridge. The matching-section dimension given in Fig 3 assumes a velocity factor of 0.95 for the 450-Ω line.

Trimming the matching section to size is the only adjustment necessary with the EDZ. Make the transformer a little long to begin with, and shorten it an inch or two at a time to bring the system into resonance. (You can check resonance with a noise bridge or by monitoring the SWR.) Do *not* change the length of the elements—the EDZ's gain and directivity depend on its elements being 0.64 λ long.

Phasing Two EDZs for More Gain and Directivity

Properly phased, two extended double Zepp antennas can give improved gain and directivity over a single EDZ. Fig 4 compares the calculated horizontal directivity patterns of a single EDZ and an array consisting of two EDZs spaced at 1/8 λ and fed 180° out of phase. Fig 5 compares the vertical radiation patterns of the single and phased EDZs.

Fig 6 shows the dimensions of a practical two-EDZ configuration. With proper adjustment, it exhibits an SWR of 1.3:1 across the 24-MHz band. In the array I built, lightweight broom handles serve as spreaders between the element ends; the center spreader is a wooden slat. I used nylon rope to haul the array up between two trees. This antenna system works well, but poor propagation has precluded a thorough tryout so far. The contacts I have had with it have been entirely satisfactory.

The matching method shown in Fig 6 is somewhat clumsy because the combined length of the phasing lines is greater than the spacing between the EDZs. The feed method shown in Fig 7 should be easier to build because the combined length of the phasing lines equals the spacing between

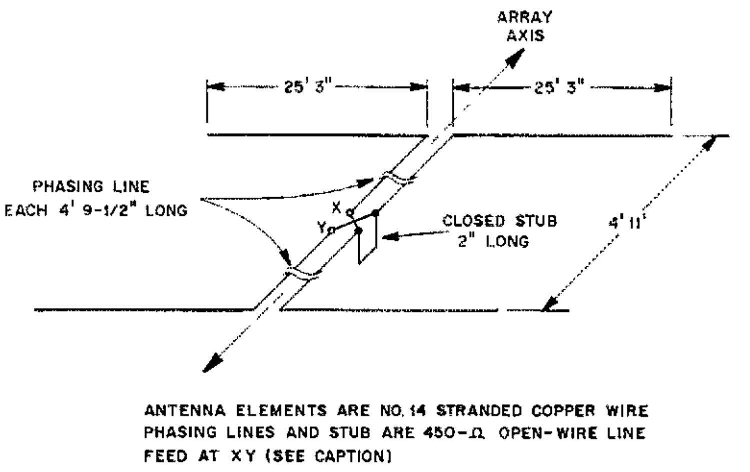

Fig 6—One method of phasing two EDZs for greater gain and directivity. The array is bidirectional, with maximum radiation occurring along the array axis. The impedance across points X and Y is 50 Ω, balanced; with a 1:1 balun at XY, the array can be fed by means of 52-Ω coaxial cable. The stub, 1.5° long, cancels a capacitive reactance of approximately 13.5 Ω at the feed point. This array works well, but its matching system is clumsy because the combined length of the phasing lines is greater than the spacing of the two EDZs. Fig 7 shows a proposed feed method that takes up less space.

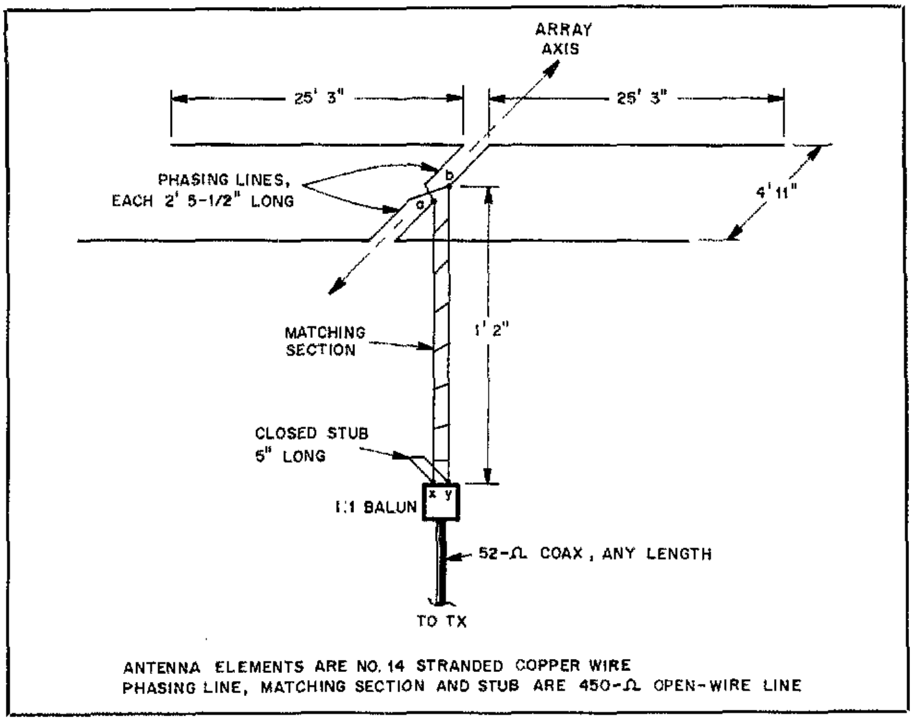

Fig 7—Proposed alternative method of phasing two EDZs. In this arrangement, the length of each phasing line is half the EDZ spacing. Calculated impedance across points a and b is 15-*j*112 Ω. The matching section—11° in length—transforms this to a calculated impedance of approximately 55-*j*32 Ω (balanced) across points x and y. The stub, 4° long, cancels the capacitive reactance (32 Ω). A 1:1 balun transformer allows the array to be fed by means of 52-Ω coaxial cable. See text.

the EDZs. I have not tried this matching method, but I'm confident that my calculated dimensions are close to what will actually be encountered.[4]

Conclusion

If the extended double Zepp has caught your attention, but 12 meters hasn't, you can scale the linear dimensions given here for other bands of interest. Once your EDZ is up and working, I think you'll agree that the performance of the "old-fashioned" extended double Zepp isn't old-fashioned at all!

Notes

[1] *The ARRL Antenna Book*, J. Hall, ed. (Newington: ARRL, 1984), p 5-4.
[2] *The ARRL Antenna Book*, p 6-8.
[3] K7KGP's matching technique is a "reinvention of the wheel" of which he can be proud. Termed the series section transformer, it appears in *The ARRL Antenna Book* and *The ARRL Handbook*. The series-section material in these books is based on Frank A. Regier, "Series-Section Transmission-Line Impedance Matching," *QST*, Jul 1978, pp 14-16.—Ed.
[4] K7KGP's calculations were confirmed by Rus Healy, NJ2L, of the ARRL HQ Technical staff, using the Smith®Chart and the Mini-Numerical Electronics Code (MININEC) on an IBM® personal computer. Data for the plots in Figs 4 and 5 were also generated by means of MININEC.—Ed.

New Products

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Contact Communications Specialists, 426 W Taft Ave, Orange, CA 92665, tel 800-854-0547, for more information. Price class: $50 for either kit.—*Mark Wilson, AA2Z*

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Strays

I would like to get in touch with...

☐ anyone with a manual/schematic for a CREI Model 255 oscilloscope. Albert Clarr, KO9N, 8116 East 20 St, Indianapolis, IN 46219.

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