The 'BRD Zapper: A Quick, Cheap and Easy "ZL Special" Antenna

Here's a multipurpose directional wire antenna that has its origins in Kraus, Windom and Newkirk *(who?—Ed.)*.

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Working Europe from Chicago with low power on 21 MHz, using an indoor, bent-ends W8JK bidirectional wire beam (Fig 1),[1] is fairly straightforward fun. Voltage feed via a λ/4 stub, gamma-matched to coax, is hard to beat for Spartan simplicity. No worry about balancing element currents, no nit-picking with element lengths. Just make the whole system symmetrical and dip it to your favorite frequency by adjusting the stub-shorting point.[2] The 8JK has a similar pattern and good gain all the way from the fundamental to the second harmonic, so it's really a multiband antenna. You can roll the whole thing up in three minutes when it's not in use.

One problem: The bidirectional characteristics of the 8JK cause my ears to be flattened regularly by undesired signals from the direction opposite Europe. Unless you're in the geographical center of a three-way QSO, the unused lobe of this antenna can be a nuisance. Question: Is it feasible to convert easy 180° bidirectionality to tricky 135° *uni*directionality without resorting to clumsy center-feeding, multi-wire-dipole elements, balanced gammas, etc?[3]

Yes—because there's a *uni*directional ZL Special lurking in our little 8JK. The principal difference between the W8JK and the ZL Special lies in the phasing: In the 8JK, the elements are fed 180° out of phase; in the ZL Special, they're driven 135° out of phase. Therefore, instead of feeding the antenna near the stub's shorting point, we'll need to feed it λ/16 from the stub's shorted end. That's where the feed path to one element is λ/8 (45°) longer or shorter than the other, which, after the stub's 180° phase reversal, produces the 135° phase shift that we're looking for between the elements.

You can find the proper feed point on the stub by "sniffing" signals of known origin along *one side* of the stub with the insulated center conductor of some coax hooked to a receiver. (Start looking for this point by measuring λ/16 up from the bottom of the stub.) It's refreshing to hear Europeans rolling in while most of the murderous rearward signals now barely budge the S meter! Directivity is reversed at the opposite stub point (Fig 2).

So he's in there all right, that ZL Special, but coaxing the wily rascal out for an honest day's work is a challenge. The ZL Special has a very sharp null in one direction when the element phasing is right, but unbalancing the stub could cost us that null. Fortunately, when the system is resonant, the 135° tap point has a moderately high resistive impedance, making for

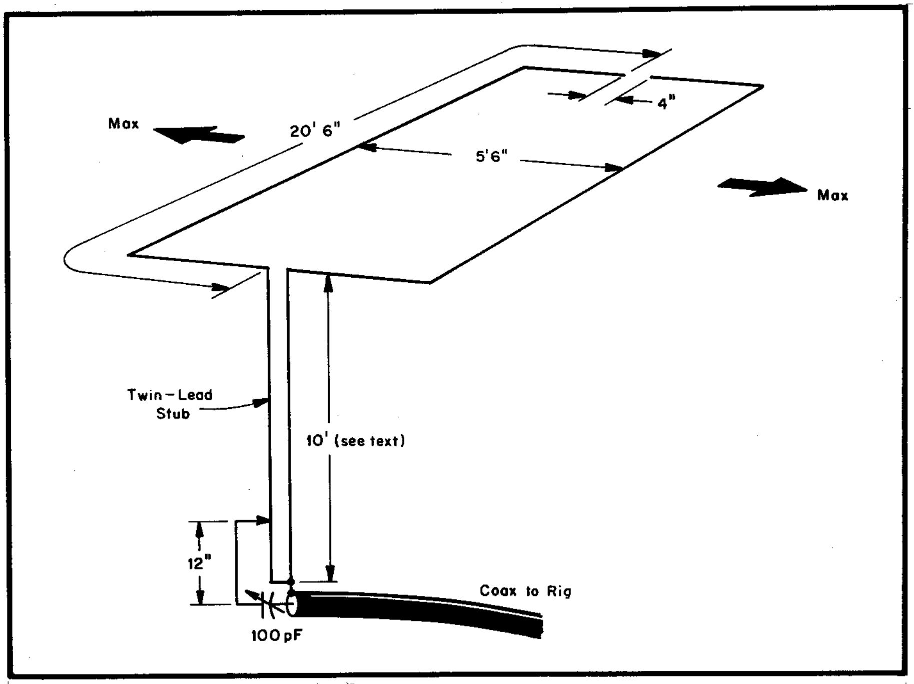

Fig 1—W9BRD's W8JK wire beam for 21 MHz, made to fit the dimensions of the town-house bedroom that it occupies. Its dimensions aren't critical, although the element lengths should be close to λ/2 (total, each), the stub should be λ/4 or odd multiples, and the element spacing should be close to λ/8. At the bottom of the stub, connect both stub wires and the coax braid together, after resonating the system as outlined in Note 2. The 12-inch tap distance and 100-pF variable capacitor constitute a gamma match that brings the stub impedance to 50 Ω.

[1]Notes appear on page 29.

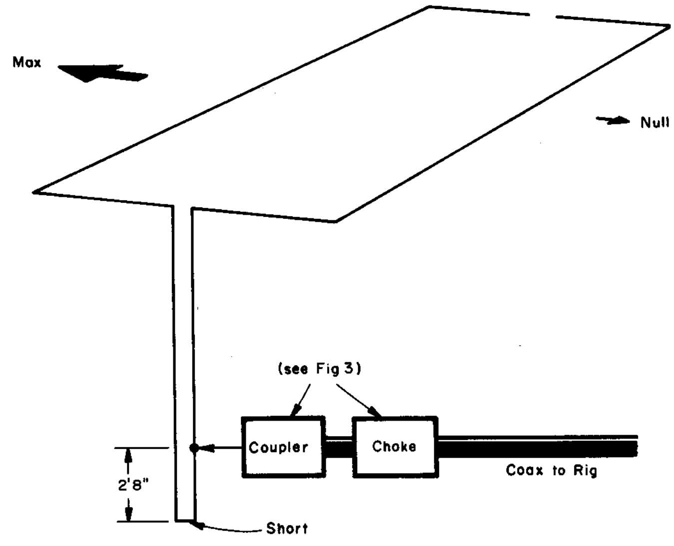

Fig 2—The antenna of Fig 1 configured for unidirectional operation with 135° element phasing. Resonate the system as described in Note 2 and connect the coupler via a very short wire to one leg of the stub about λ/16 above the stub-shorting point. The coaxial choke is needed to eliminate feed-line radiation, which can ruin the rearward null that this system provides.

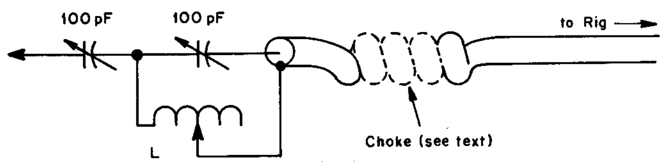

Fig 3—Matching-network and coaxial-choke details for the 'BRD Zapper. L consists of 10 turns of no. 16 wire, 1½ in. diam, air core, space wound. For 100 W or less, broadcast-type variable capacitors are suitable. Adjust the inductor-tap point for lowest SWR. The coaxial choke is made of 30 turns of RG-58 wound on a ferrite rod.

easy matching of the antenna to 50-Ω coax via a T network (Fig 3).

Pattern distortion through incidental radiation and pickup must be minimized. Excessive leakage would put us right back at the mercy of those loud signals from the other direction. Therefore, the coupler must be built in the most compact form possible, mounted right at the stub, and isolated to keep the feed line from distorting the pattern. Such isolation is done at W9BRD via a home-brew coaxial choke made of 30 turns of the antenna's RG-58 feed line wound on a ferrite rod just before the matching network.

Because feeder radiation could upset the stub balance—and thus spoil the antenna's rearward null—the single-wire run from the matching network to the antenna had better be no more than an inch or two. Here, I'm borrowing on the single-wire-feed theme by Windom. Any circuitry above the choke will be hot with RF, so a bulky meters-bells-and-whistles matching unit will not do. It's best to use a compact, bare-bones, dedicated network. Run the stub all the way down from the flat top if possible. Incidentally, the tap point on the stub corresponding to the best rearward null is higher on the stub for element spacings wider than λ/8. System Q is also lower with wider spacings, but gain is maximum at λ/8.

As for the stub itself, TV twin lead is okay indoors, but close-spaced, end-fire elements mean high voltages and currents. If the stub is to be longer than a quarter wavelength (odd multiples only) or outside in the weather, low-loss, open-wire line is a must. You can run the stub of an outdoor version directly into the shack for handy directivity reversal.

Though we've been talking horizontal, this setup should be equally interesting as a vertical. By the way, when the elements are placed horizontally, one above the other, 135° phasing accentuates radiation and reception at high angles. Neat for local traffic nets, Sweepstakes and Field Day!

Notes

[1] Dr John D. Kraus, W8JK, first described this antenna in *QST* in "Directional Antennas with Closely Spaced Elements," *QST*, Jan 1938, pp 21-23, 37. Reprints are available from the ARRL Technical Department Secretary for $2 each plus a business-size SASE. Kraus also discussed this antenna in three articles in *Radio* magazine in 1937 and 1939, and in *Proceedings of the IRE*, Feb 1940.

[2] The easiest way to do this is with a dip meter. Jab a straight pin into each leg of the stub near the bottom, short the pins together and couple the dip meter into the system by bringing the dip meter close to the shorted pins. Locate resonance using the dip meter and measure the dip-meter frequency on your receiver. Move the pins up or down the stub and repeat the process until the antenna is resonant at or near your frequency of interest. When you've done this, cut the stub, strip and solder a short in the wires where the pins were located at resonance.

[3] Of course, this antenna can be center fed in either its bidirectional or unidirectional modes. Such flat tops are described in J. Hall, Ed., *The ARRL Antenna Book*, 15th ed, (Newington: ARRL, 1988), Chapter 8, and J. Devoldere, *Low-Band DXing* (Newington: ARRL, 1987), pp 2-101 through 2-102.

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