Greatly Increased Bandwidth From Simple Modifications To Your Present Beam

The Broad-Minded Yagi

BY T. E. WHITE*, K3WBH

Yagi aerials have been the backbone of h.f./v.h.f. amateur communications for years. Yet their one most glaring deficiency is very restricted bandwidth. A properly designed and built Yagi is limited to 1 or 2 per cent of design frequency before s.w.r., gain and bandwidth degradation begin. And the longer the beam the narrower the coverage.

This is no problem for those who hang around only on a certain frequency. But to cover entire bands, such as 220 and 420, with a single beam, the traditional Yagi leaves much to be-desired. Those starting from scratch on v.-u.h.f. would do well to construct log periodics. But for established amateurs with existing Yagis, there is another solution: modify your present antenna.

Fig. 1 shows a twin-driven element Yagi with two folded dipoles, cross-connected and fed from the rear or larger DE, not the front, as in an LPY. Parasitic elements remain the same as with a single DE beam, except that spacing is somewhat closer than "normal." Note that each dipole is shorted a certain distance in from each end. And each is physically the same in top and bottom portions, i.e., they are not "ratio" dipoles and perform no large impedance transformation. Balanced line (300 ohm) is connected directly to DE-A. Matching transformers at the antenna are not recommended, as we are trying here to eliminate all bandwidth-restricting devices. Use balanced line all the way down to the shack and there insert a simple broad-response donut torroid balun to permit 50 ohm coax connection to the rig. Use the minimum run of coax you can.

Not only are we making the beam less frequency-selective but also less "impedance-selective." S.w.r. remains nearly constant, and below 2.25:1 max., across the entire 144 and 220 MHz bands, and almost all the 420 MHz band.

The beam in fig. 1 may be extended by adding directors (at same spacing as D4-5), each 1/4 in. progressively shorter for 144, and 1/8 at 220 and 420. But there is no point in adding fewer than 3 at once, as the gain increase is not worthwhile with only one or two. And to go beyond 8 directors total starts to negate the very broad-bandedness we are seeking. Better to stack two bays vertically, which will give 14 db with 5 directors and nearly 16.5 db with eight.

Since we are here supposedly modifying an existing Yagi using your present boom and even if possible some of your present parasitic elements, boom sizes are not given, but this configuration will work well with booms of 3/4 to 1 in. diameter (or square) on 144, and 1/2 to 3/4 on 220 and 420. However it is recommended that all elements, including the dipoles, be of uniform diameter, and the cross-connectors the same. This should be 1/4 in. tubing for 144, and 1/8 semi-hard drawn rod for 220 and 420.

* *c/o CQ Magazine*

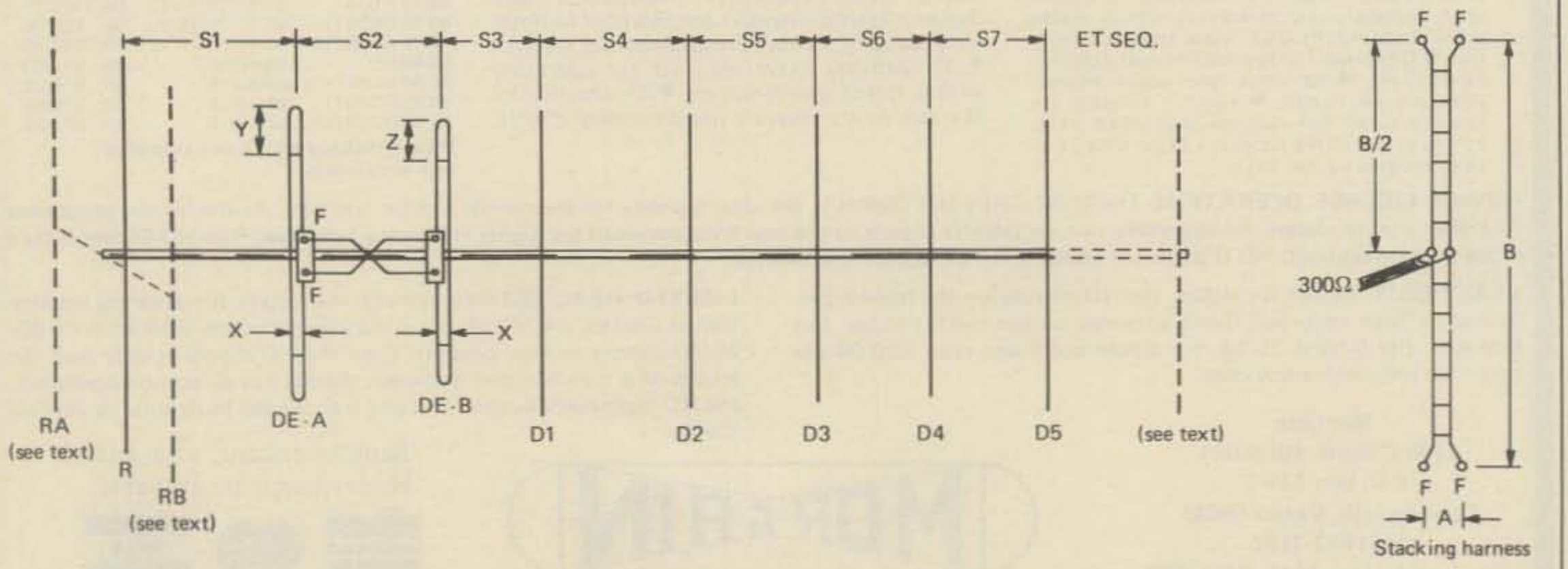

Fig. 1- A twin driven Yagi antenna.

KEY	144	220	420	KEY	144	220	420
R	47 1/4	31 1/2	15 3/4	S1	14 1/8	8 3/4	4 3/8
DE-A	41 7/8	28	14	S2	11 1/2	6 3/4	3 3/8
DE-B	31	20 3/4	10 3/8	S3	8 3/8	5 1/2	2 3/4
X	1 1/2	1 1/4	3/4	S4	14 1/8	8 3/4	4 3/8
Y	14 1/8	8 3/4	4 3/8	S5	14 1/8	8 3/4	4 3/8
Z	7 3/8	5	2 1/2	S6	14 1/8	8 3/4	4 3/8
D1	38 1/4	25 1/2	12 3/4	S7	14 1/8	8 3/4	4 3/8
D2	37 7/8	25	12 1/2	R-RA*	22	15	7 1/4
D3	34 3/4	22	11 1/2	R-RB*	22	15	7 1/4
D4	34 1/8	21 7/8	11 3/8	Stacking if used			
D5	33 7/8	21 3/4	11 1/4	A	2	1 3/4	1
NOTE:				B	82	82	28
* = If used.							

Fig. 2- Various dimensions for the twin driven Yagi antenna.

Dipole shorting straps for all bands are 1/16 aluminum sheet 3/8 in. wide, curled and press-fit around dipoles and cinched with 6-32 hardware. Clean connections are essential. Spray or brush Mosley Antenna Coat or similar over and around these wraps.

By the way, a tolerance of ± 1/4 in. at 144 and 1/8 at 220 and 420 in element lengths in perfectly ok, so don't throw away all your parasitics. You may have some already cut to size. And as to element spacing, ± 1¼ in. on 2m., 3/4 in. on 220 and 1/2 on 420 are also permissible, so check your existing spacings before ripping everything up. It may be possible to "drop in" the dual dipoles by simply relocating a director or two.

The 2 meter beam will perform well on adjacent MARS and CAP frequencies, and if mounted vertically will be an excellent receiving aerial for the 152-174 Public Service band, as well as satellites in the 136-142 band. The 200 model will receive TV channels 11-13 far better than a "consumer type" all-channel TV antenna, and will receive aviation, government, and aerospace signals in the 225-250 band. In fact, if mounted on an azimuth/elevation steerable mount, and additional reflectors RA and RB are installed, it makes an excellent receiving antenna for space shuttle eavesdropping. The 420 version will work well into the Public Service 450-470 band.