HF-SAT Antenna

An easy-to-build dual-band HF satellite antenna.

by Edward Oros AC3L

Here is an antenna for the nineties. It's strong, computer designed, and has lots of gain.

This is a no compromise dual-band antenna. Instead of using traps, this design interlaces two separate antennas (the 10 meter band and the 15 meter band) on one boom. This is a full-size, four-element beam on 10, and three elements on 15 meters!

The design uses large 1"-diameter aluminum tubing to keep ohmic losses to a minimum, to survive heavy winds and withstand ice build-ups in the winter.

Since it is both a 10 and 15 meter antenna, it is the perfect antenna for anyone interested in working the RS satellites which have uplinks on 15 and downlinks on the 10 meter band.

The HF-SAT produces plenty of gain on both bands. The antenna was computer optimized for maximum forward gain (hence the low front-to-back). The 10 meter band has close to 9 dBd gain (free space), and the 15 meter band produces over 7 dBd (also free space). (See the sidebar.)

Photo A. The finished HF-SAT Antenna in service. (Photo by N3LSS.)

Construction

Since all elements are of 1" tubing, it's just a matter of laying out each element end-to-end and cutting the last piece to the required length for that element. Each 1" section is joined to the next piece via a third piece of aluminum (0.875" diameter) which slides into the 1" sections (see Figure 1). Drill holes on either side of the joint and use bolts to secure each section in place. The elements are attached to the boom by muffler clamps.

Feeding

Current baluns should be used at each feed point. They can be commercial models, or just loop several turns of the cable to create your own balun. Separate cables are run to each feed point and then run to a mast-mounted switch box or straight into the shack. You can choose you own favorite matching method but in this case a gamma match was used at each feed point, and this worked well. If the antenna is mounted at 40 feet, the 10 meter antenna should have an impedance near 13 ohms.

The 15 meter antenna is around 27 ohms. If you'd like, you could just use a two-to-one (2:1, 50-25 ohms) balun to match the 15 meter antenna, and skip the gamma match here. Figure 2 and Table 1 show all of the necessary measurements for the beam.

Test Out

The initial tests of this antenna were per-

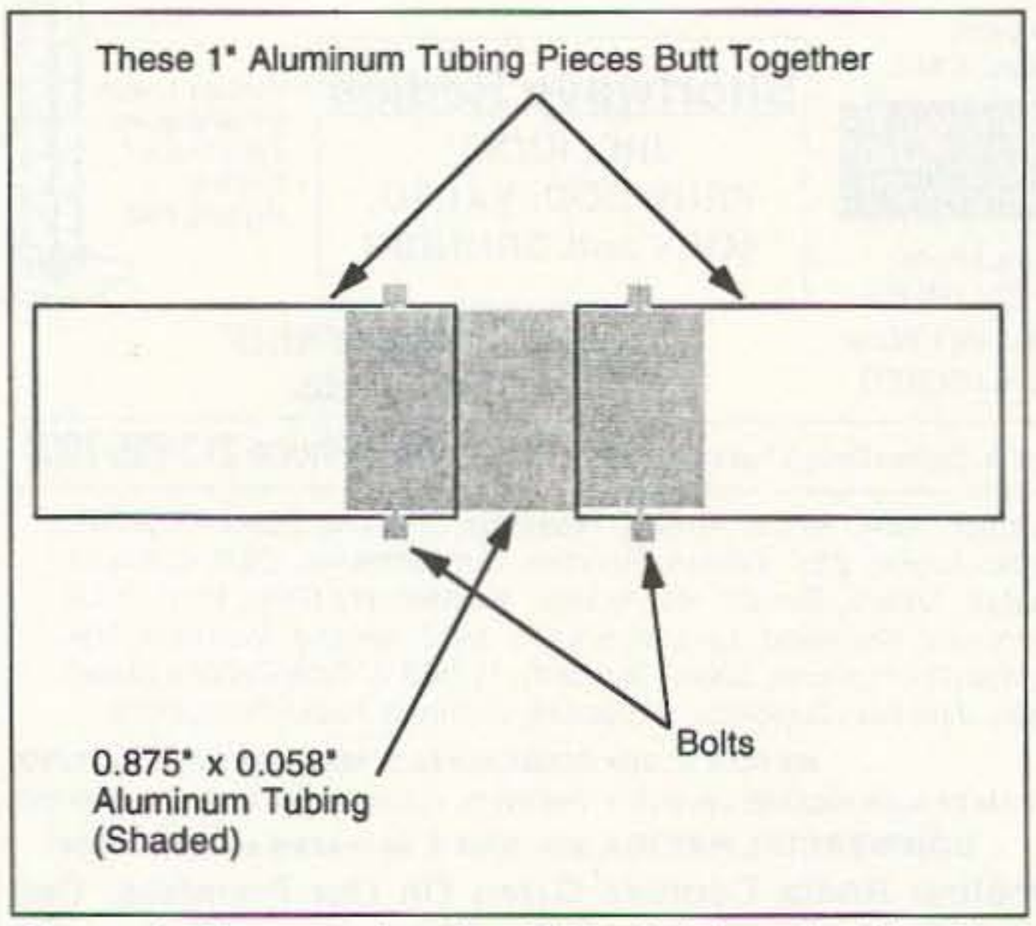

Figure 1. Construction detail for joining the 1" tubing sections.

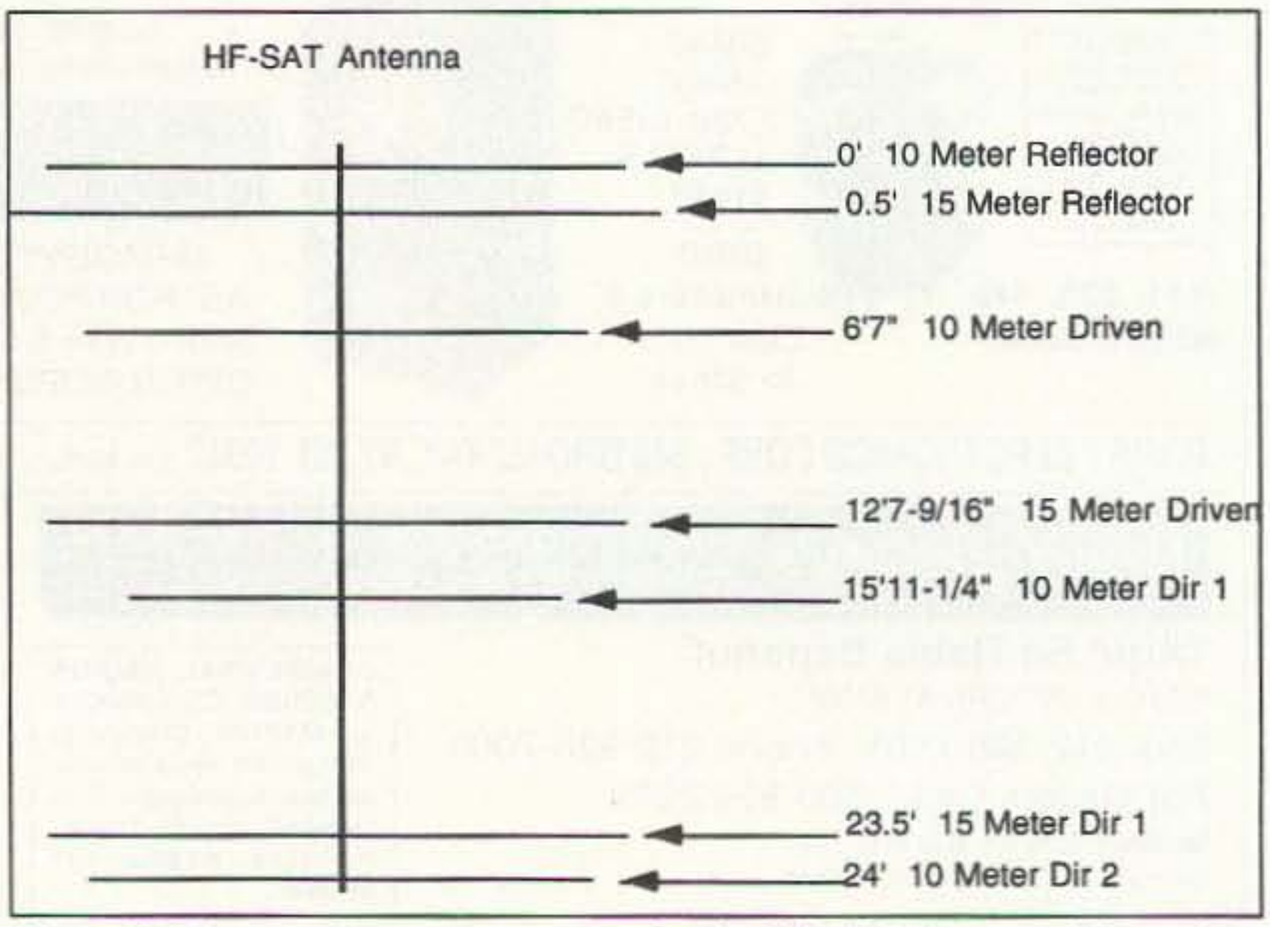

Figure 2. Construction measurements for the HF-SAT Antenna. Dimensions shown indicate element positions on the beam.

Gain Figures for the HF-SAT Antenna

10 Meter Band		15 Meter Band	
Free Space	Above Ground (40') Max Gain @ 12 Deg	Free Space	Above Ground (40') Max Gain @ 15 Deg
Gain 8.92 dBd	13.82 dBd	7.36 dBd	12.22 dBd
F/B 12.47 dB	12.08 dB	7.13 dBd	6.86 dB
Imped. 13.1+ j 2.1	12.8 + j 1.4	27.40 + j 1.5	27.00 + j 1.3

Table 1. Element Lengths

Reflector	16' 10-13/16"	22' 2-1/4"
Driven	15' 10-9/16"	21' 1-3/4"
Director 1	15' 9-9/16"	20' 11-5/8"
Director 2	16' 6-1/2"	N/A

formed while on a 10-foot pole. The comparison antenna was a three-element, 10 meter monobander created using standard beam formulas and was not computer designed. Local tests showed that the HFSAT antenna was already slightly better signal-wise than the 40-foot-high three-element beam. Once the HF-SAT antenna was taken up to the 40-foot height it proved to be 10 dB stronger than the original casually-designed antenna—an impressive and worthwhile increase in gain, to say the least. The antenna has been excellent on both bands. 73

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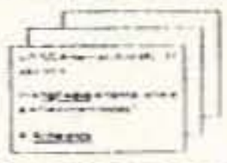

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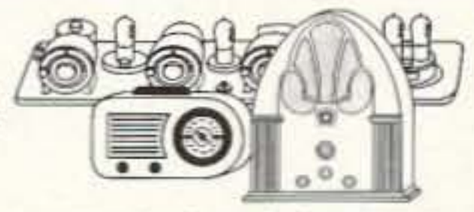

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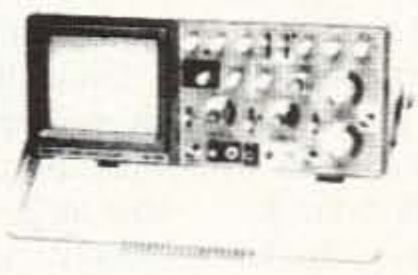

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