CQ REVIEWS:

The Hy-Gain Omni DX-88 Eight-Band Vertical Antenna

BY JOHN J. SCHULTZ*, W4FA

The DX-88 is an omnidirectional, unity-gain, self-supporting vertical antenna that operates in the 80, 40, 30, 20, 17, 15, 12, and 10 meter amateur bands. It is about 25 feet high. The antenna can be mounted at ground level or in an elevated position. However, it *must* be used with a set of radial wires. You can put together a set of radials with the information supplied in the DX-88's manual, or Hy-Gain offers two assembled radial sets—the GRK-88 for ground-mounted installations and the RRK-88 for elevated mountings, such as on a roof. The difference between the two radial sets is basically that the GRK-88 radials are non-resonant and all of the same length (14 feet), while the RRK-88 radials are resonant (two ¼-wavelength radials on each band except 80 meters). Table I presents a summary of the specifications for the DX-88. Note that there is a power limitation on the 30 and 17 meter bands only. On all other bands the DX-88 will accept a full 1500 watts PEP of power.

Specifications

Electrical

Frequency:
Transmit—80, 40, 30, 20, 17, 15, 12, 10 meter amateur bands
Receive—3–30 MHz, tunable in 8 international SWL bands
Input impedance: 50 ohms
VSWR at resonance: less than 1.5:1 if using recommended radial system
Maximum power: 1500 watts PEP, 700 watts average (maximum power on 30 meters is 250 watts average; maximum power on 17 meters is 500 watts average)
Input connector: SO-239

Mechanical

Maximum height: 24 ft. 9 in. (7.54 m)
Weight, net: 18 lb. (8.2 kg)
Weight, shipping: 22 lb. (10.0 kg)
Maximum mast O.D.: 1⅝ in. (41 mm)
Wind survival, unguyed: 75 mph (121 kmph)

Table I– Hy-Gain specifications for the DX-88.

Electrical Makeup

Fig. 1 shows an overall view of the antenna, except that no radial system is shown. Easily noted are the trap assemblies for the eight bands covered by the antenna. The entire length of the antenna is active on 80 and 40 meters. The 80 and 40 meter "traps" near the base of the antenna are not really "traps" in the sense of being resonant circuits, although they are composed of inductive and capacitance elements. The 80 meter "trap" provides inductive loading to resonate the entire antenna on that band, while the 40 meter "trap" has an effective capacitive action to resonate the entire antenna on that band. These two "traps" are interactive in setting the tuning for the 80 and 40 meter bands, as will be mentioned later.

The remaining traps are true high-Q, tunable resonant traps which isolate one-quarter wavelength sections along the vertical radiator starting with the 10 meter trap and progressing in direct order with the 12, 15, 17, 20, and 30 meter band traps. Each of these traps can be tuned independently if you want to optimize the SWR in any given portion of a band. They can also be tuned to favor various SW broadcast bands if the antenna is to be used for SWL purposes (90, 74, 49, 41, 31, 25, 22, 19, 16, 13, and 11 meter band coverage).

The SWR bandwidth of the DX-88 follows fairly much the classical model for trap/loaded multiband antennas—that is, progressing from fairly broad on the 10 meter band to quite restrictive on the 80 meter band. The DX-88 operates with a 2:1 or less SWR on the entire 30, 17, 15, 12, and 10 meter bands. The 2:1 SWR bandwidth is about 250 kHz on 20 meters, 200 kHz on 40 meters, and 50 kHz on 80 meters. These bandwidths do not mean that the antenna cannot effectively radiate over wider frequency excursions. It will, for instance, radiate over the entire 80 meter band, but then an antenna tuner is required to bring the SWR at a transceiver's antenna output connector to a value such that the transceiver will deliver full power output into the antenna.

Roughly, the 2:1 SWR bandwidth for a vertical antenna such as the DX-88 can be viewed as the usable bandwidth for use with a solid-state transceiver *sans* antenna tuner. This generalization cannot be applied to any antenna form. With more complex antenna forms severe radiation pattern changes may also take place outside of a defined SWR bandwidth. However, that is getting far outside of the scope of this article. The SWR bandwidth of the DX-88 is certainly quite good on the bands above 10 MHz. On the 80 and 40 meter bands you have to decide which portion of those bands to favor when adjusting the antenna, or use an antenna tuner for complete flexibility. Fig. 2 shows a set of typical SWR wires.

Mechanical Makeup

The DX-88 is made of extremely sturdy aluminum tubing sections starting with a hefty 1⅜" × 41" thick-wall tube as the base section. The tubing sizes decrease slowly down to a still hefty 7/16 inch O.D. tube for the very top section.

You have to partly assemble the traps. That is, the coils for the traps come completely assembled. You must assemble the capacitors associated with each trap by telescoping two different diameters of tubing, which are insulated from each other, and then clamping the capacitor assembly across one or more of the coils. The value of the capacitors can be varied by sliding the inner tube of the capacitor in or out of the outer tube. This is how the antenna is tuned on each band. A bit more assembly work is required, but tuning flexibility is achieved, and you can fairly easily disassemble the capacitors in case an arc-over needs to be cleaned up. The coil covers may also be removed if it should ever prove necessary to get at the coils.

Stainless-steel hardware is used for all electrical connections (e.g., clamps for telescoping tubing sections, bolts, etc.). Aluminum clamps are used to hold capacitors across the coils.

Overall, the construction is very rugg-

*302 Glasgow Lane, Greenville, NC 27858

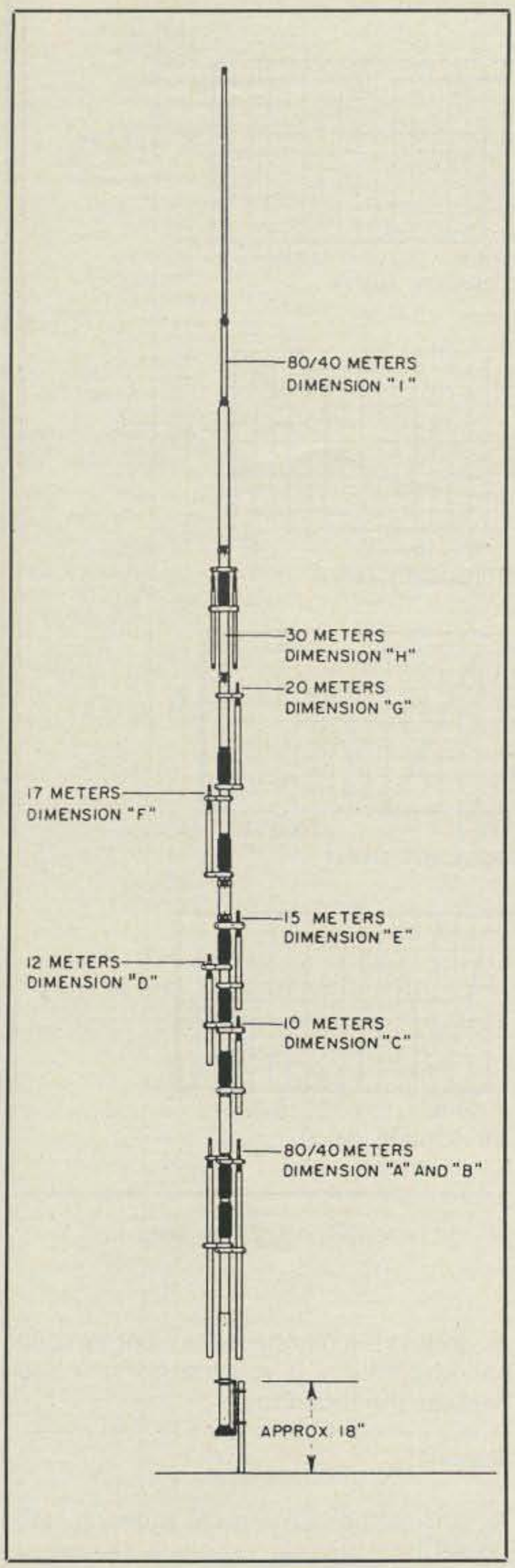
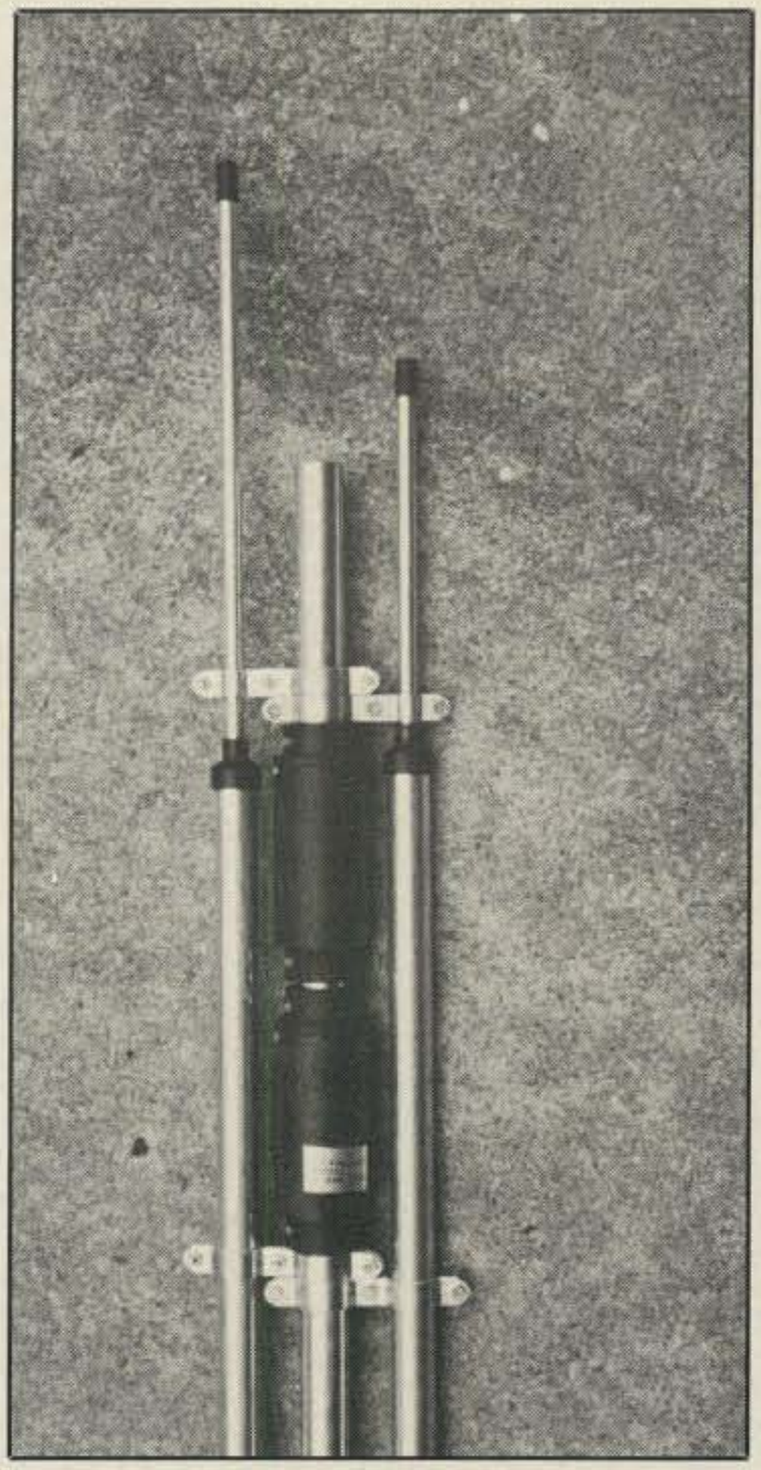
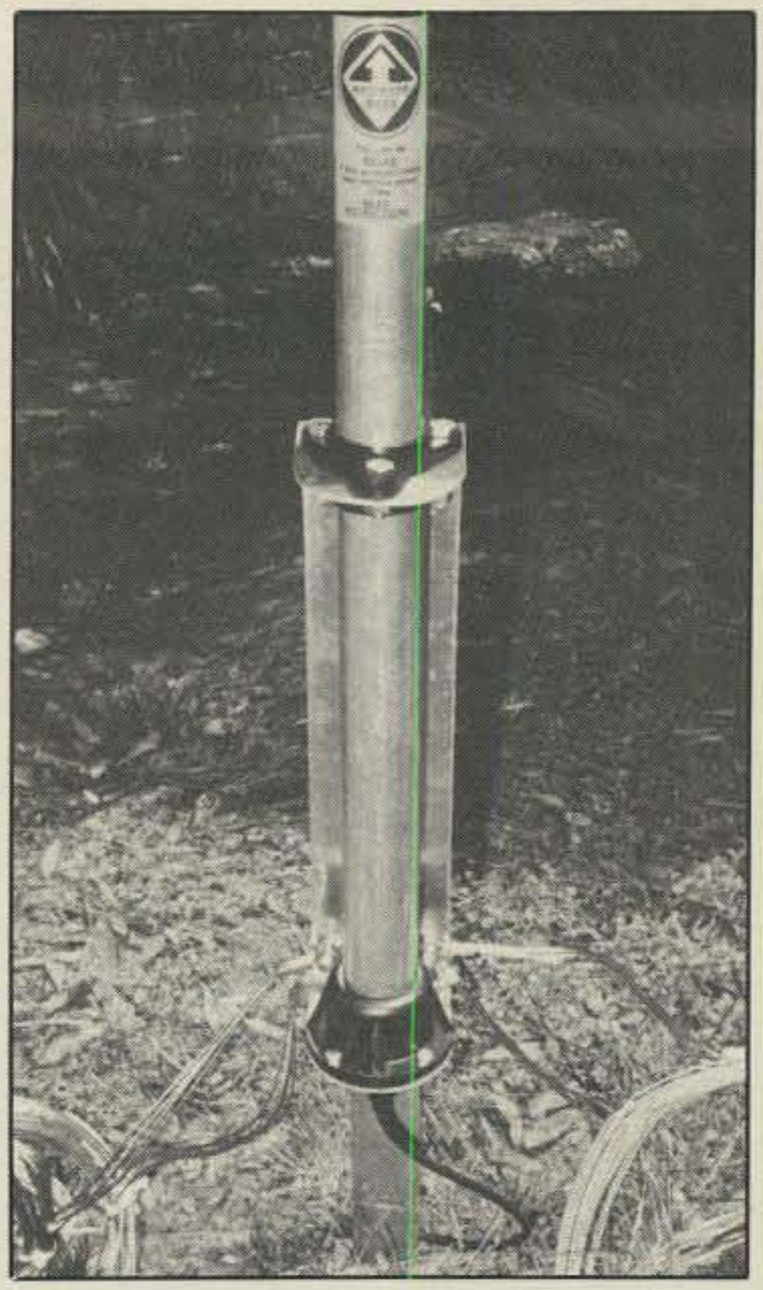


Fig. 1– Makeup of the DX-88. Overall height is about 25 feet. The dark areas are coils, while the "sidearms" are tunable capacitors associated with the coils.



This is a view of two of the very sturdy traps in the DX-88 (actually the 80/40 meter ones shown towards the bottom of fig. 1). The coils come completely assembled, but you have to construct the tubular capacitors shown on each side. The traps are quite service-friendly should something go wrong. The capacitors can be disassembled, and the coil covers are removable.



The base of the DX-88 is held in place by an elongated "U" bracket which in turn would be attached to a support pipe. The 16 radial wires of the GRK-88 radial kit are shown still coiled up before being spread out on the ground. Not shown is an optional but highly recommended DC grounding coil which attaches across terminals provided. The coil (9 turns of #12 enameled wire on a 1 inch diameter form) can easily be home brewed. Besides providing DC grounding, the coil improves the SWR bandwidth a bit on 40 and 80 meters.

ed, and the wind survivability rating of 75 MPH without guying seems conservative. In reality the wind survivability would probably depend mainly on how you secure the base of the antenna to a support.

The longest element used in the antenna measures 55 inches, and there are no overly large "L"-shaped pieces. Therefore, by telescoping sections of tubing together wherever possible, you could probably come up with a fairly compact 20 lb. package if you wanted to transport the antenna. Of course, an additional allowance would have to be made for the radial system, transmission line, etc.

Radial Systems

As was mentioned before, there are two radial system possibilities for the antenna depending upon whether it is to be ground mounted (radials on the ground or buried) or mounted in an elevated position such that the radials are above ground. Fig. 3 shows the radial system for ground-mounted installations, and fig. 4 shows the resonant radial system for an elevated mounting, typically on a house roof. The radials, by the way, may droop over an edge of a roof, but they must be insulated from the roof.

Hy-Gain does note that in the case of a ground installation longer and more radials will reduce ground losses and raise the efficiency of the antenna. However, they do estimate that the gain of the antenna on 7 MHz will be only 2 to 3 dB down (depending on soil conditions) from that of a system having 120 radials!

A salt-water beach installation with a long ground rod might be the only circumstance under which the antenna would operate efficiently without a radial system.

Assembly

Assembly is quite straightforward using only simple hand tools and a measuring tape. The manual for the antenna contains ample illustrations, and it is just a question of following the steps described in order. The assembly of the capacitors is simple enough, but a bit boring. I laid out all of the parts in a large garage space area and proceeded from there. Then the antenna was moved outside for tuning and final installation.

I found it took as much time to tune the antenna as to assemble it. The manual describes the tuning procedure quite fully and presents eight graphs that detail di-

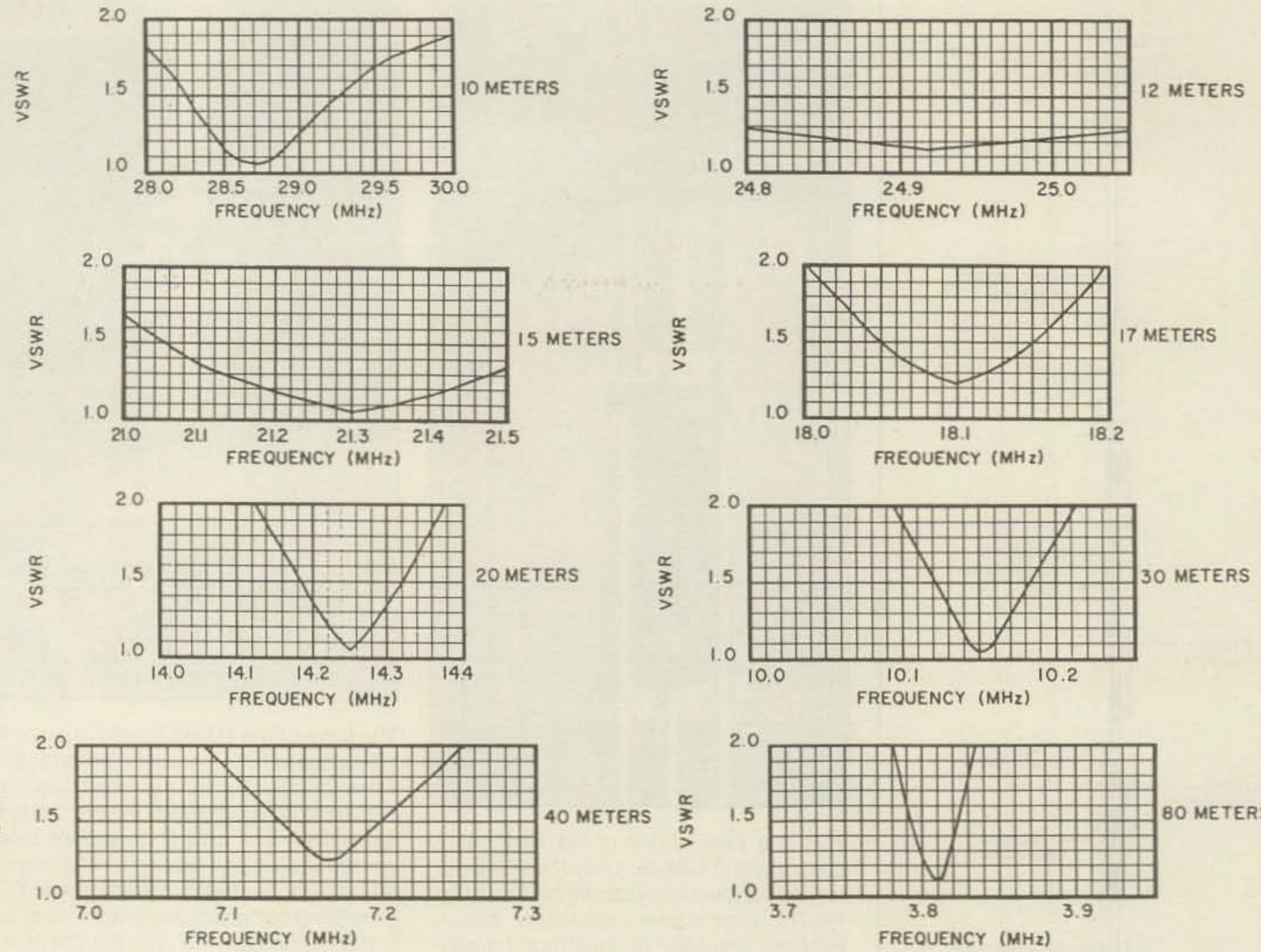


Fig. 2– Typical SWR curves. Tuning adjustments can be made on each band to change the resonant points as desired.

mensions for the trap tuning for each band. The SWR bandwidths that I obtained using a ground-mounted installation with a GRK-88 radial kit (fig. 3) paralleled very closely those shown in fig. 2. However, the SWR minimums within three bands were slightly off from where I wanted to place them. Therefore, the antenna had to go up and down several times until the adjustments were completed. Having dimensions "off" by ½ inch or less on some bands can easily shift the SWR minimum point by 100–200 kHz. If the antenna is mounted in an elevated position and a resonant radial system used, in many cases you can also fine tune the antenna by slightly varying the lengths of the radials for each band. This may be far easier than working on the antenna itself.

The 80/40 meter adjustments do interact and would require both back and forth adjustment of the 80/40 meter capacitors plus adjustment of dimension "I" (fig. 1) if you really want to get things set up to perfection. I didn't worry about it too much, since I expected to use moderate power and an antenna tuner, if necessary, on 80 meters. I just used the manual dimensions to have the 40 meter SWR low center around 7.15 MHz. The resultant SWR bandwidth on 40 meters perfectly satisfied my operating needs. On 80 meters the SWR low point appeared slightly below 3.8 MHz, but it didn't matter too much since I had expected to use an antenna tuner anyway to have complete operating flexibility on the 80 meter band. The antenna did, by the way, load up quite easily on 160 meters using an MFJ-989C tuner. I assume the overall antenna efficiency to be quite low on 160 meters, but it certainly has to be much better than even physically smaller 160 meter antenna forms.

How far you want to go in getting resonant points within each band precisely where you want them is a bit of a moot question. If the antenna is to be used with a transceiver having a built-in automatic tuner and running "barefoot," it hardly matters if the resonant points are off a bit, especially on 40 meters and below. If you are going to run 1500 watts PEP into the antenna on 80 meters *without* using a tuner, getting the resonant point correct can become critical if you are not going to damage the trap circuits.

Results

As an eight-band vertical antenna, the DX-88 can provide excellent service. I ran 500 watts PEP into the antenna on all bands without any problems. I received good reports whether working DX on the higher frequency bands or working short skip on the lower frequency bands. At times, especially on DX contacts, I even got better reports with the vertical than when I used a 160 foot long dipole with tuned feeders that I have at about 55 feet between some pine trees. It would be too much to expect such performance consistently from the DX-88. However, the DX-88 will undoubtedly be around long after the next storm takes away the wire antenna as those pines start to sway.

Summary

The DX-88 is a good choice for those am-

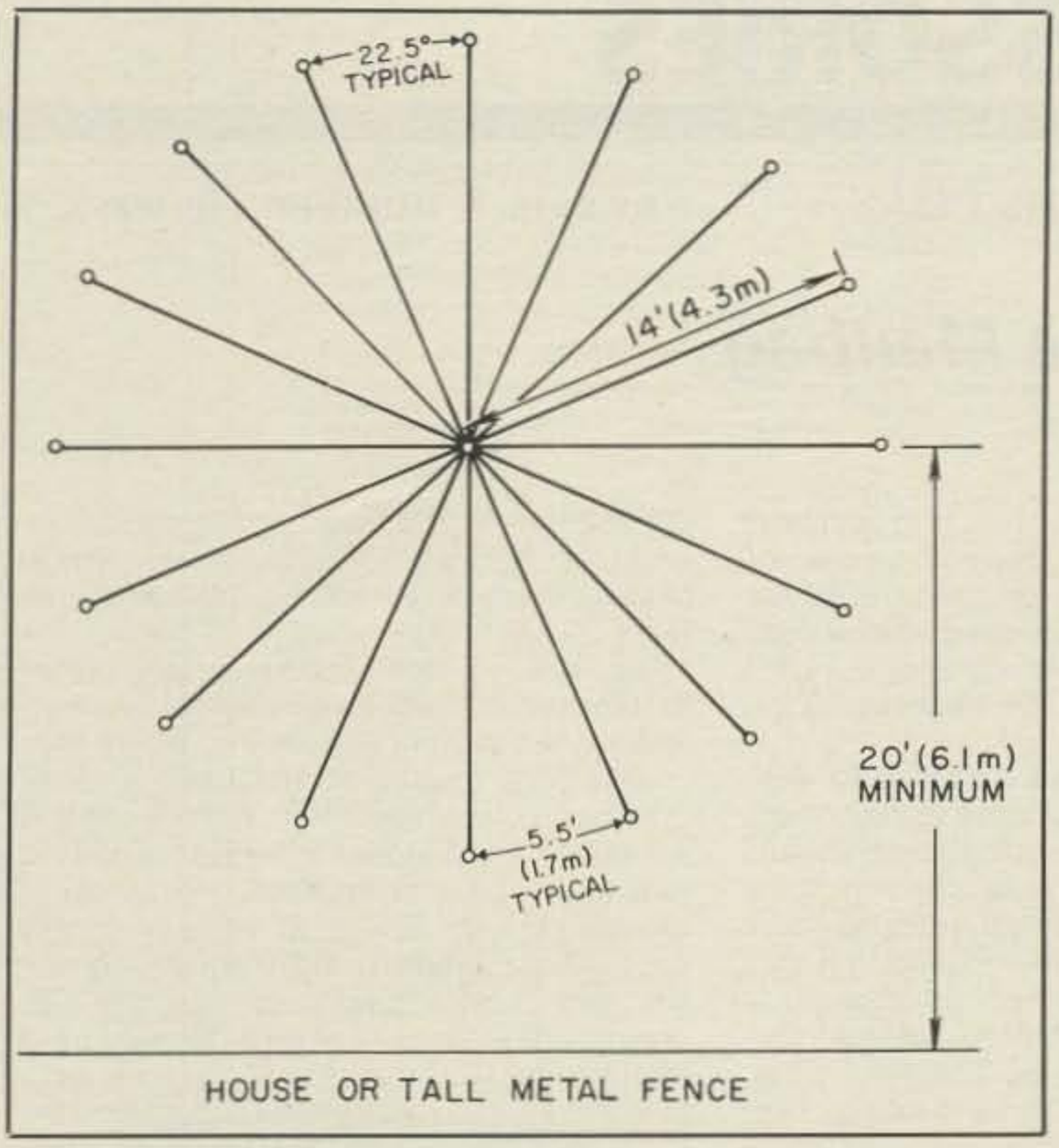


Fig. 3– Radial configuration for ground-mounted installations.

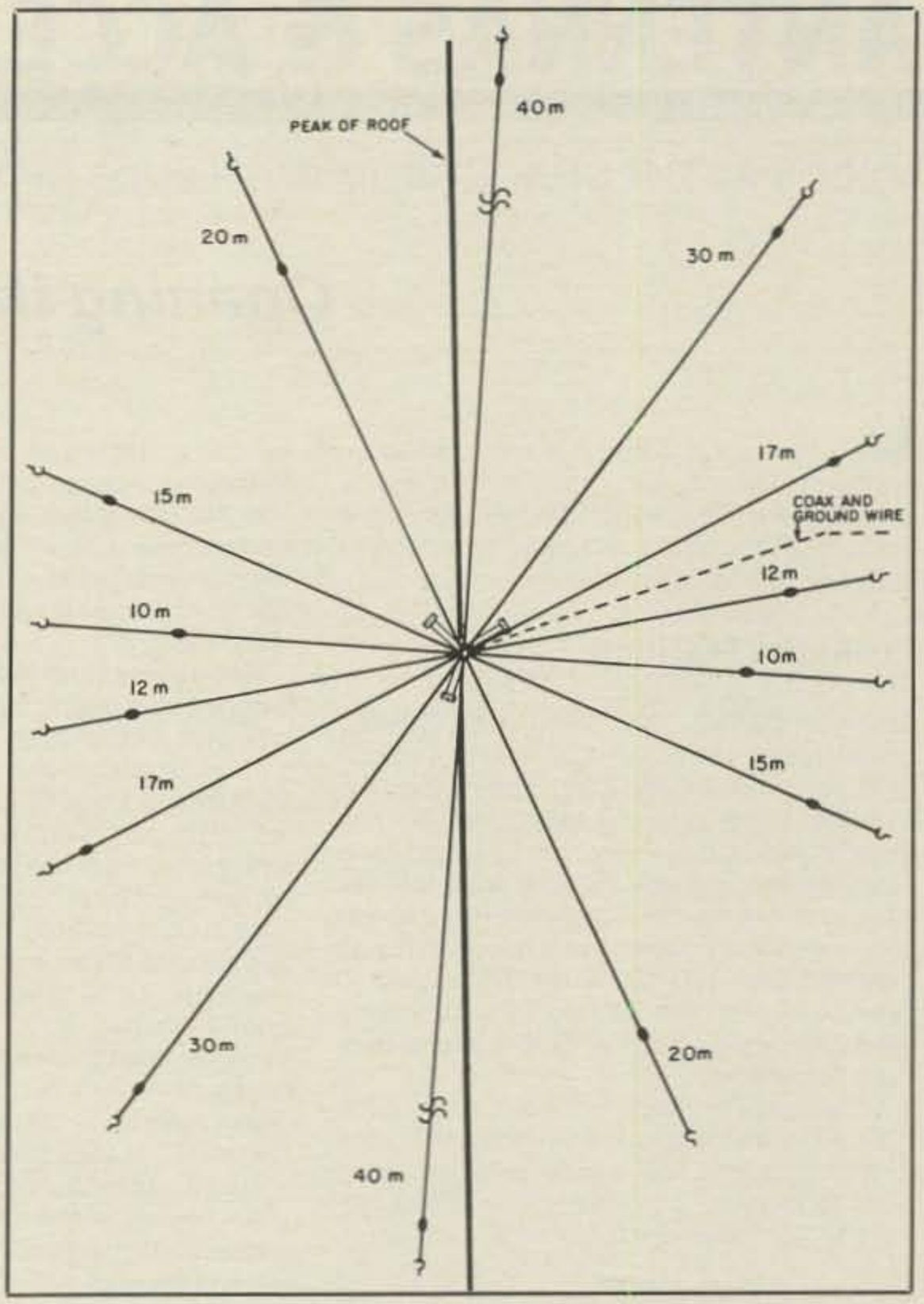


Fig. 4– Resonant radial configuration for elevated mounting such as on a house roof.

ateurs who want eight-band coverage in a single antenna that is reasonably small and that can generate some good low-angle radiation. At about 25 feet high, the antenna is not overly conspicuous. I'm not sure if it would help or hurt, but those amateurs who have problems with antenna "visibility" might consider placing some small flags on a ground-mounted DX-88. It might add some rationale to the existence of the capacitor "sidearms."

Seriously, two other roles that the DX-88 could well fill are those of a semi-hardened ground-mounted antenna and an all-band portable antenna. The survivability of the DX-88 should be excellent if it is mounted on a concrete pad or metal plate with long ground rods. It might therefore well complement more elaborate antenna installations for emergency communications.

For portable applications most of the antenna can be preassembled and pretuned if it is to be used with a known radial system. Those who like to explore DX locations might find this of interest. I didn't attempt to time field assembly of the antenna, but I would estimate that depending upon how many of the traps are preassembled, you could get the assembly time down to less than half an hour.

The DX-88 manual alludes to modification of the antenna being possible for 160 meter operation, but provides no details. There would appear to be no reason why the antenna could not be further inductively loaded to get it to operate, *sans* tuner, on 160 meters with perhaps a 10–15 kHz SWR bandswitch. But manual, or remote switching with a relay, of a 160 meter loading coil would be indicated.

The Hy-Gain DX-88 vertical antenna has an amateur net price of $299. The ground-mounted radial kit, the GRK-88, is priced at $42. Two other options will be available at the end of the summer (presumably by the time you read this); both prices are to be announced. The first is the RRK-88, the roof-mounted radial kit, and the second is a 160 meter add-on trap, model number 191-S. The antenna is manufactured by Telex/Hy-Gain, 9600 Aldrich Ave. South, Minneapolis, MN 55420. CQ