A Sloping Quad For 80 Meters

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WITH the decreasing effectiveness of the 10, 15, and 20 meter bands due to the gradual drop in the sunspot cycle, more and more amateurs are migrating to 80 meters. To many, it is the natural thing to do when the upper bands close down at night. Not only does it provide excellent short and intermediate skip operation, 80 meters is a good DX band as well at this time.

For the newcomer or the old timer returning to 80 meters, the antenna becomes a challenge. Dipoles extended to about 120 feet require considerable room and the problem of "sky hooks" at either end becomes perplexing. Many amateurs have erected Inverted V antennas with excellent results. No doubt, there are more Inverted V antennas being used on 80 meters than all other antennas combined.

My return to 80 meters graduated from the dipole to the Inverted V, with the apex on a tower at 45 feet and just below the 20 meter beam. Results were good and I enjoyed numerous contacts throughout the U.S. with a few Caribbean and South American contacts. However, the European and African DX stations were seldom within grasp. I had to envy the signals put out by W7RM and W2HCW with their rotary beams at 170 ft. and 120 ft. respectively. All too often, I could not even hear the DX stations that they gave Q-5, S-9 signal reports to.

My exposure to the 80 meter quad was through a contact with W9LZX, who used what he called a "lazy" quad, which was draped on bushes and low trees around his campsite. His 45 watts input with the quad a few feet above ground registered 20 db over S-9 on my Collins receiver. A signal level hard to believe, and this contact lasted an entire hour, during which time his signal never dropped below an S-9. After this contact I was determined to put up a quad even if it had to be a "lazy" quad draped on the bushes around the house.

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The first quad went up much easier than I anticipated. It was cut for 3.8 mHz using the standard quad formula:

$$\text{Total Length of Quad (feet)} = \frac{1005}{\text{Freq. (mHz)}}$$

For 3.8 mHz, the length rounded out, came to 264 feet, or 66 feet on each leg. For a comparison with a basic antenna, the quad is simply a folded dipole in the form of a square and has similar broad band characteristics. The impedance at the feed point is a function of the height above electrical ground as with any antenna, as shown in the table, for various heights above electrical ground for a horizontal quad.

Impedance In Ohms	Height In Wavelength Above Electrical Gnd.	Height In Feet At 3.8 mHz
300	1.0	259.0
288	.75	194.25
300	.5	129.5
380	.4	103.6
350	.3	77.7
288	.25	64.7
230	.2	51.8
160	.15	38.85
104	.1	29.5
72	.075	19.4
50	.05	12.95

The sloping quad can be fed at the center of any of its 4 legs or at a corner. Best results can be obtained with the point of feed at the highest point of the quad above ground. This places the high current point at the highest level above electrical ground. It can be fed with open wire, twin lead, or coaxial cable. However, with coax feed, a 2:1 or 4:1 balun should be used for the best impedance match.

It must be noted that the impedances listed in the table for various heights above electrical ground, are for a horizontal quad. The impedance for a sloping quad will fall somewhere in between the highest and lowest points of the quad. A standing wave or impedance bridge would serve well for this purpose.

The radiation characteristics for a horizontal quad are similar to those of a folded dipole at the various heights above electrical ground. For the average amateur, heights from .15 to .25 wavelength on 80 meters are common. At these heights, the radiation from a horizontal quad would be mostly straight up, or at approximately 90 degrees from the horizontal. A sloping quad at the same average height will have a radiation pattern tilted somewhat in the direction of downward tilt.

The radiation effects are similar to the sloping dipole used so effectively on 40 and 80 meters. The purpose is to tilt or slope the radiation pattern in the desired direction. The greater the tilt, the lower the radiation angle and consequently, the longer the skip distance. The ideal would be a vertical quad with an extremely low angle of radiation in the two directions bisecting the plane of the quad.

At this QTH, the original installation was a horizontal quad at an average height of 55 feet above ground level. It was fed at one corner with RG-8/U coax and the s.w.r. was over 5:1, indicating an impedance of approximately 260 ohms at the feed point. Although the transmitter (Collins KWS-1) could be effectively loaded into such a high s.w.r. on the 52 ohm coaxial line, I contemplated an open wire line or at least a 4:1 balun using RG-8/U. Numerous contacts at both short and intermediate distances (up to 1500 miles) proved the horizontal quad superior to the Inverted V at 45 feet which had an s.w.r. of 1.2:1. This simply proved the point made in the articles by W2DU in *QST*,[1] that a high s.w.r. with low line loss results in minimal loss of power. The important consideration is the capability of the transmitter to be loaded into the transmission line.

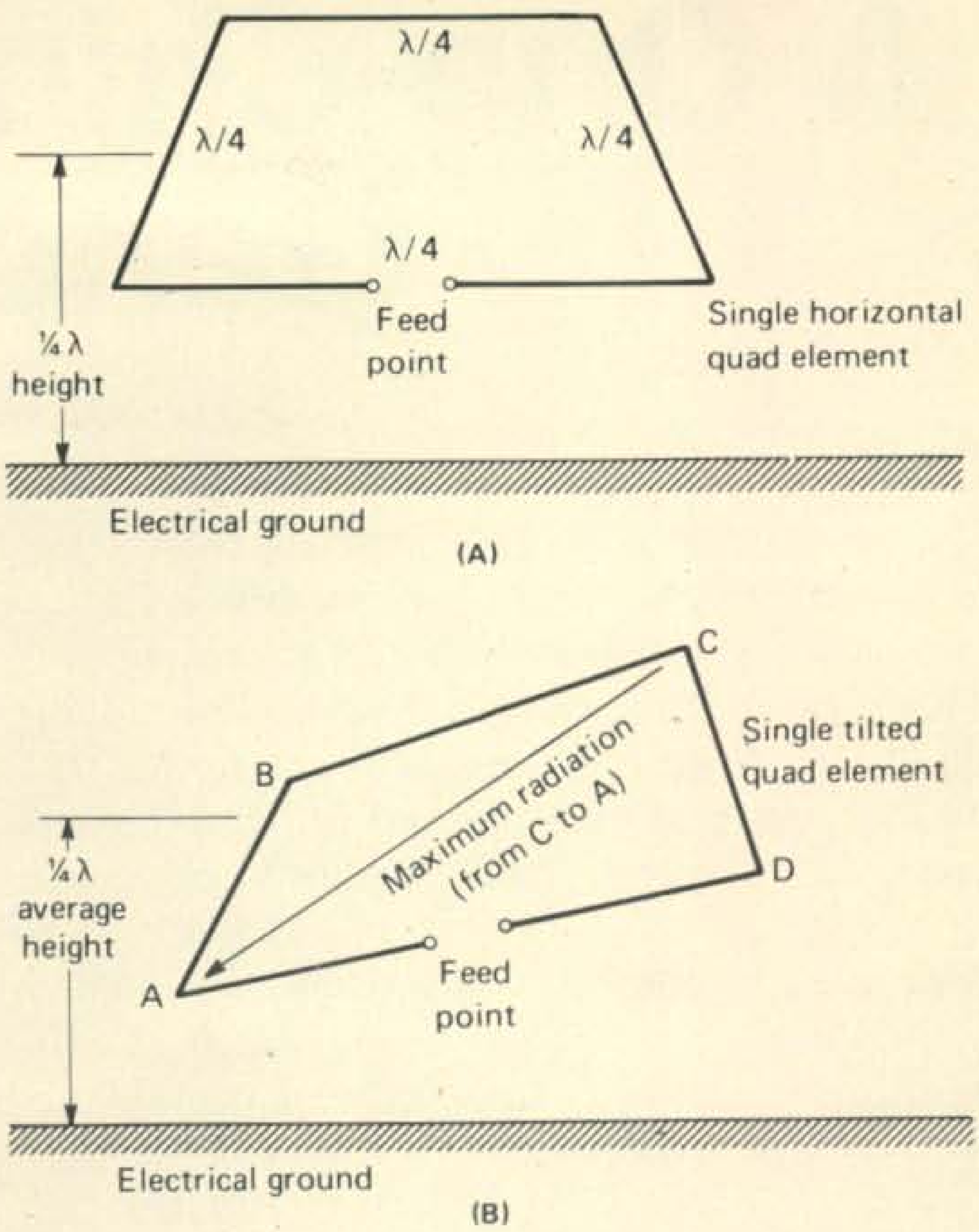

Fig. 1—(A) A single full-wave quad element in the horizontal position at one quarter wave elevation will exhibit a radiation pattern similar to a dipole at the same height. Greatest radiation will be at 90° to the horizontal. (B) By sloping the quad element somewhat in the desired direction of maximum radiation, a substantial lowering of the angle of radiation is achieved, in addition to gaining a significant amount of directivity. In actual situations, the average height of the antenna above ground will often be less than ¼ wave, resulting in unpredictable, though manageable feedpoint impedances.

Being an ardent fanatic for low s.w.r., I began experimenting with the height of the quad to obtain a lower s.w.r. More by accident than design, I found that by lowering the western end of the quad to 25 feet, the s.w.r. dropped to slightly less than 2:1. Referring to fig. 1 (B), corner A is at 25 feet, corners B and D at 45 feet, and corner C at 60 feet.

Using the Inverted V at 45 feet as a control antenna, I checked the signal level with numerous stations and found the sloping quad outperforming the Inverted V by more than an S-unit, especially to the west and southwest. In order to verify this signal enhancement to the west and southwest, I again

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[1]Maxwell, M.W., W2DU, "Another Look At Reflections," *QST*, Apr., June, Aug., 1973.

NPN transistor will discharge the capacitor in less than the required time since the base current of 4.3 ma times any reasonable beta value would produce a very high discharge current. Let's assume that we have some 2N5828s on hand, and decide to use one here. The only precaution we need to take is limiting the peak transistor current to its rated maximum of 100 ma. Since the possibility exists of the voltage across the capacitor rising to +10 volts if the drive pulses should fail, R_2 should be calculated for this worst case condition.

$$R_2 = \frac{10 \text{ Volts}}{0.1 \text{ Amp}} = 100 \text{ ohms.}$$

As a final check, we should make sure that the time constant, $R_2 \times C$, is well under our 5 millisecond retrace time. $R_2 \times C = 100 \times 10^{-6} = 100$ microseconds, which is quite satisfactory.

A word on the selection of the PNP transistor Q_2. The current through the base divider was arbitrarily picked as 1 milliamp. Since this is higher even than the emitter current, the base voltage will "stay put" even if the Q_2 beta h_{FE}) is not very high in short, almost any silicon PNP transistor would be satisfactory.

Dayton Hamvention

Just a reminder that the annual slow-scanner's pilgrimage to Dayton occurs in April. This year, for the first time, it will be a three day affair with the exhibits opening at noon on Friday, April 26. The Amateur Television Forum is scheduled for 1400 on Saturday afternoon, and there are sure to be some interesting talks on SSTV. And anyone who thinks that amateurs are no longer able to contribute to the advancement of the radio/video arts are invited to see this year's ham-designed SSTV equipment exhibit! For additional information write: Dayton Hamvention, P.O. Box 44, Dayton, Ohio 45401.

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Sloping Quad [*from page 47*]

raised the western corner of the quad. The resulting signal reports dropped off in that direction as well as the received signals. On lowering the western corner, the signals improved as anticipated. Contacts with many west coast stations, as well as Canton Island (KB6) and New Zealand, proved without doubt that the sloping quad outperformed the horizontal quad to the west and southwest.

Having an Inverted V which I no longer used, I decided to convert it into a sloping quad to favor the northeasterly direction to Europe. In order to avoid interaction between the two quads and staying within the limits of our acre of land, the second quad slopes from 45 feet to 20 feet in a northeasterly direction. The enhancement of signals to the north and northeast was confirmed on contacts to New England, Canada, and Europe. Comparative reports when switching between the two quads showed a 10 db greater signal into Europe with the second quad. The same 10 db difference was noted on contacts to the west. It is interesting to note that on receiving, the difference between the two quads hardly ever exceeded 6 db. However, I could now hear signals that were buried in the noise when using the Inverted V.

After 8 months of use, I have not changed my 52 ohm feed line or installed a balun to reduce the impedance mismatch and improve the s.w.r. I doubt that I will ever make the change because of the ease that the transmitter loads into the 2:1 s.w.r. on each of the antennas. For convenience, I feed the antennas at corner D in fig. 1(B), although feeding at a higher point would probably improve my signal reports.

Installation is relatively simple if adequate trees are available. I used monofilament fishing line and a 3 ounce weight to throw the line into the trees. It was a simple matter to pull up the nylon lanyard and then the antenna to the desired height. The antennas are made of 12 gauge standard electrical wire with plastic insulation. The plastic insulation serves no purpose other than making it easy to slide the insulators along the wire. I used circular insulators at the corners with rubber tape stays at the 66 ft. points to prevent the insulators from sliding. I would recommend wire no smaller than 18 gauge.

Small lot owners should not shy away from this antenna. It can easily be accomodated on a lot 70 × 70 feet. In fact lengthwise, it takes far less space than a full dipole for 80 meters. The sloping quad antenna is normally a single band antenna, however with an antenna tuner, such as the Johnson Matchbox, and open wire line, it should perform well on all bands. Without a tuner, and with a 3:1 s.w.r., I have used both quads on 40 meters with good results ■