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THE COMPACT VERTICAL DIPOLE

The following material was extracted from earlier editions. Figure and Equation sequence references are those from the 21st edition of *The ARRL Antenna Book*

A variation on the HVD (half-wave vertical dipole) theme is the *compact vertical dipole*, or CVD. The CVD uses capacitance-hat loading on each end of a shortened vertical radiator, as shown in **Fig 57C**. Some call this "top hat" and "bottom hat" loading. Les Moxon, G6XN, called this method of loading a shortened antenna simply "end loading." The vertical wire for his 40-meter CVD is 25 feet high, with 15-foot long horizontal loading wires on each side, top and bottom.

K8CH Compact Vertical Dipole

The top loading wires needn't be perpendicular to the vertical radiator, although that is convenient if you construct the antenna from aluminum tubing. K8CH described a wire 30-meter CVD in the 2006 Edition of *The ARRL Handbook.* This used #14 wire throughout, with sloping top loading wires. It was designed to be suspended from a tree at least

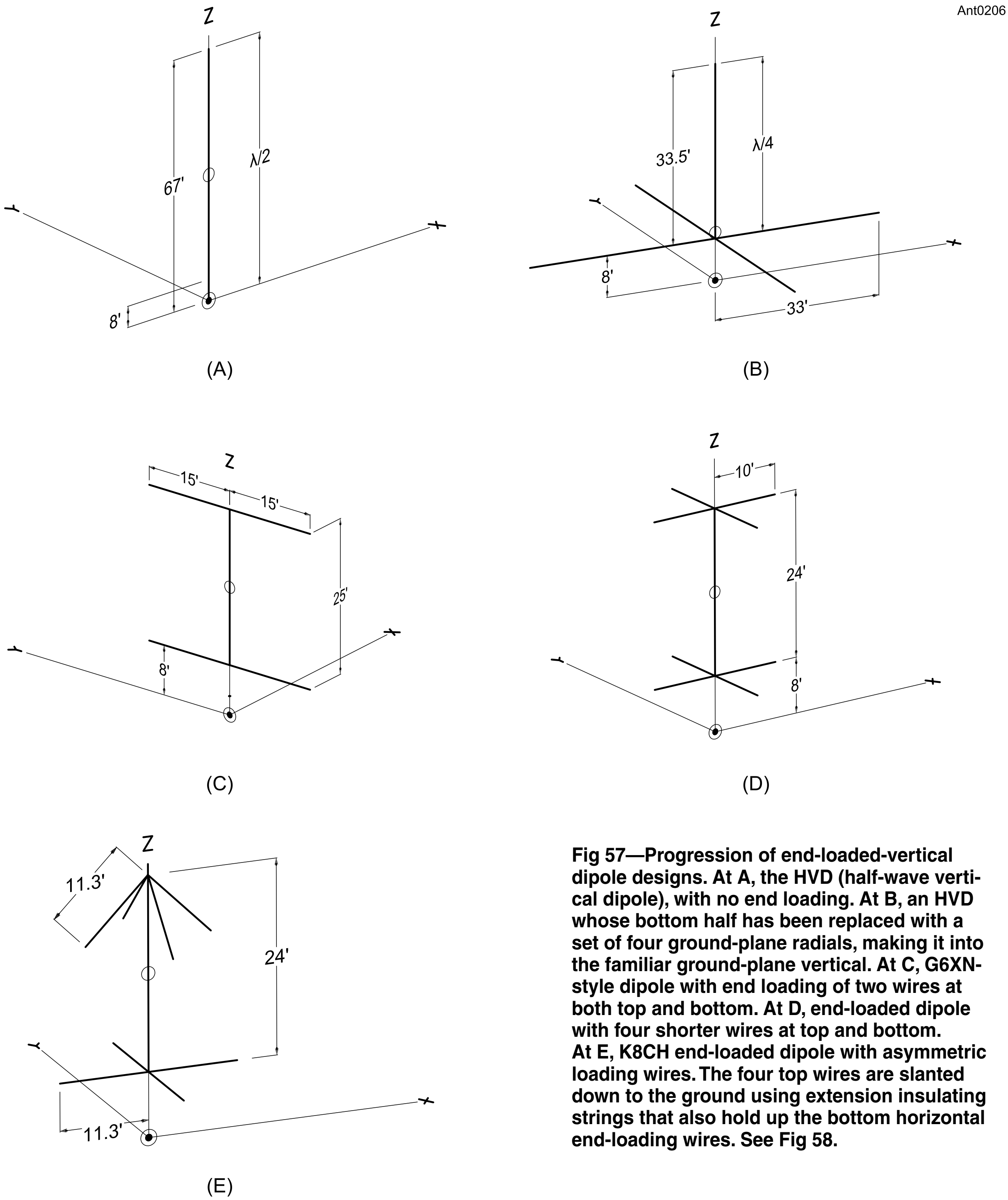

Fig 57—Progression of end-loaded-vertical dipole designs. At A, the HVD (half-wave vertical dipole), with no end loading. At B, an HVD whose bottom half has been replaced with a set of four ground-plane radials, making it into the familiar ground-plane vertical. At C, G6XN-style dipole with end loading of two wires at both top and bottom. At D, end-loaded dipole with four shorter wires at top and bottom. At E, K8CH end-loaded dipole with asymmetric loading wires. The four top wires are slanted down to the ground using extension insulating strings that also hold up the bottom horizontal end-loading wires. See Fig 58.

32 feet high to keep all wires 8 feet or more above humans and animals. The vertical radiating wire is 24 feet long, and the eight top and bottom end-loading wires are all 5 feet 9 inches long. See Fig 57E and **Table 9**, CVD 1.

The top loading wires slant at an angle of 45º down to the ground, using insulating strings that also support the ends of the bottom loading wires, holding them out so that they are horizontal. See **Fig 58**. There is a small loss of gain because of the “umbrella” shape of the top loading wires, and the 2:1 SWR bandwidth is diminished slightly from the horizontal case. This isn’t a problem on a narrow band like 30 meters.

A 40-meter version of this antenna, CVD 6, also uses a 24-foot long vertical radiator, 8 feet high at its bottom. It uses 11.3-foot long radial wires made of #14 wire, again with the top four slanted down at 45º. This CVD has a 2:1

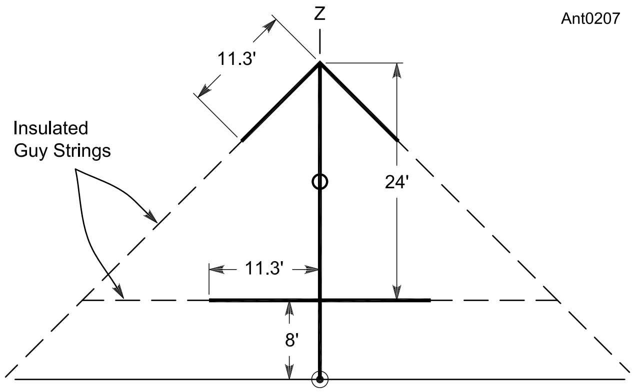

Fig 58—Layout of CVD made using #14 wire suspended from a tree branch.

SWR bandwidth of 250 kHz. It is directly fed with 50-Ω coax with ferrite-core common-mode choke baluns in the middle of the vertical radiator. An additional choke balun is used where the coax reaches ground level in order to knock down common-mode currents that might otherwise radiate onto the coax shield.

You should note the comparison of 40-meter ground-plane vertical antennas in Table 9. GP 1 is for horizontal radials that are 8 feet off the ground, while GP 2 has its radials only 2 feet high. There is some loss in gain because of the proximity of the lossy ground. The 40-meter CVD 1 and CVD 2 cases illustrate the same effect of being close to the lossy ground.

Some of the cases in Table 9 require Center Load coils to bring the antenna to resonance. Where the loading coil inductance is equal to the "Hairpin Coil" inductance, the loading coil also serves as a hairpin matching coil. Where the amount of Hairpin Coil inductance is less than the Load Coil inductance, a match is achieved by tapping the Center Load Coil symmetrically out from the center.

80-Meter CVD

The size of a CVD becomes a real challenge on 80 meters, requiring either very tall support structures or multiple loading methods to keep the vertical radiator to a reasonable length. The CVD 2 design in Table 9 shows a K8CH-style CVD wire antenna whose vertical radiator is 46.5 feet long. It requires a 54.5-foot high tree to keep the bottom end of the vertical radiator 8 feet above ground for safety. Compare this to an HVD that requires a 143-foot support of some sort to keep it 8 feet off the ground at the bottom. The CVD 2 sacrifices some 0.7 dB in gain for this difference in size, and about 75 kHz in 2:1 SWR bandwidth.

The CVD 2 would require retuning when going from CW to phone, probably by changing the length of the four bottom horizontal wires equally.

Table 9
Variations on a Vertical Center-Fed Dipole

Name	*Style Fig 57*	*Vertical Length feet*	*Spoke Length feet*	*Min. Ht feet*	*Max. Gain dBi*	*2:1 SWR kHz*	*Hairpin Coil µH*	*Center Load µH*
20 Meters								
GP	B	17.53	16.53	8	0.29	400	—	—
CVD 1	C	13	7.57	8	0.12	625	—	—
CVD 2	D	12	5.1	8	0.00	550	0.68	0.68
CVD 3	E	12.15	5.6	8	–0.01	450	0.5	0.5
30 Meters								
GP	B	24.54	23.14	8	0.04	400	—	—
CVD 1	E	24	5.33	8	–0.2	500	—	—
CVD 2	E	17	7.60	8	–0.36	400	0.82	0.82
40 Meters								
HVD	A	66	—	8	0.13	450	—	—
GP 1	B	35	33	8	–0.12	325	—	—
GP 2	B	34.5	33	2	–0.37	400	—	—
CVD 1	C	25	15	8	–0.42	450	—	—
CVD 2	C	24	15	2	–1.09	400	—	—
CVD 3	D	24	10	8	–0.55	425	—	0.25
CVD 4	D	24	5	8	–0.85	225	—	8.7
CVD 5	D	16	8	8	–1.18	175	0.94	6.8
CVD 6	E	24	11.3	8	–0.59	250	—	—
80 Meters								
HVD	A	135	—	8	0.19	225	—	—
GP	B	65.5	61	8	0.11	200	—	—
CVD 1	C	48.3	30	8	–0.27	200	—	—
CVD 2	E	46.5	21.9	8	–0.50	150	—	—