W9YPQ QST June 1937
W8MOK QST December 1954
W3KPO QST July 1956

Multiband Operation with Paralleled Dipoles

A Simple Antenna System with Coax Feed

BY H. J. BERG,* W3KPO

• The idea of connecting dipoles in parallel for multiband operation is by no means new, having been suggested at least as early as 1937,[1] and more recently by W8MOK.[2] However, the many who are not familiar with previous material are sure to find this revival of a multiband system fed with coax well justified.

The increased flexibility of the modern amateur transmitter accents the need for a single antenna for multiband operation. Few have space for an antenna farm; most of us must be content with the average-sized city lot. As a result, we can erect but one antenna.

There are several well-known ways of achieving multiband operation with one antenna. It is most often accomplished by the use of tuned feeders, or a long wire fed at the end without feeders. This requires an antenna tuner. To change bands, it is necessary to change coils in the tuner, rearrange taps, and retune. On the other hand, if the single antenna is fed with a nonresonant line, its operation must be limited to the one band for which it is cut.

An antenna commonly referred to as the "300-ohm off-center-fed Windom," has gained considerable popularity, because it is reputed to be a system that permits operation on several bands with a "flat" line. However, those who have investigated the design of this antenna have discovered that its practical operation must involve considerable compromise.[3] Many more have learned by experience that there are other disadvantages. Unbalanced feeder currents result in feeder radiation. Radiation from the transmission line as well as from the antenna gives rise to variation in the radiation pattern from band to band, feed-point impedance variation and the appearance of r.f. on supposedly grounded circuits and house wiring. The last-mentioned effect has been so bad in some cases as to ruin the performance of a well-shielded v.f.o. In spite of these troubles, many have continued to use it from lack of any other choice.

For some time, the author, in common with many others, has been in search of a simple multiband system that could be fed efficiently with coax cable. Finally, an item that appeared in *Radiotron Designer's Handbook*[4] served as a reminder of a system that was described in *QST* many years ago. The arrangement is so simple that it is surprising that more frequent use has not been made of it in recent years.

The principle of the system is shown in Fig. 1. The arrangement consists of separate dipoles for each band, all connected in parallel to a single coaxial transmission line. With one of the dipoles operating at its resonant frequency, its feed-point impedance will, of course, be suitable for matching a low-impedance line (approximately 70 ohms). The remaining *lower-frequency* dipoles will be at or close to harmonic resonance at the operating frequency. However, since their halves will be in phase, the impedance presented to the line will be high and essentially resistive. This high impedance will be in parallel with the 70 ohms of the active dipole and therefore will have negligible effect on the line termination, and little current will flow to the longer dipoles.

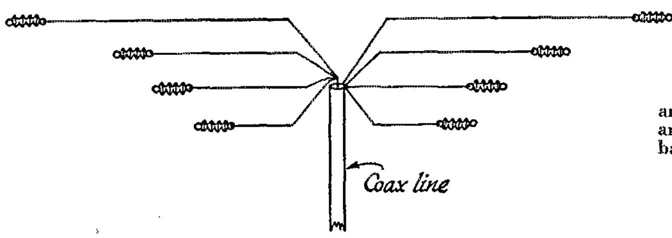

Fig. 1 — Sketch showing the arrangement of parallel half-wave antennas in the coax-fed multiband antenna system.

The remaining *higher-frequency* dipoles will present an impedance consisting of resistance and capacitive reactance. However, the resulting impedance will also be high compared to the 70 ohms of the active dipole.

A departure occurs in the case of 15-meter operation. On this band, the 7-Mc. antenna will be close to resonance at its third harmonic, and its center impedance will be low — of the order of 100 ohms or so. Also, at this frequency (21 Mc.),

* 19 Herold Drive, Irwin, Penna.
[1] W9YPQ, "Hints and Kinks," *QST*, June, 1937.
[2] W8MOK, "Hints and Kinks," *QST*, December, 1954.
[3] Wrigley, "Characteristics of Harmonic Antennas," *QST*, February, 1954.
[4] RCA, Harrison, N. J.

the 14-Mc. dipole will show inductive reactance, while the 28-Mc. dipole will show capacitive reactance. However, the resultant is still high compared to 70 ohms. Since the 7-Mc. dipole presents a fairly-close match to the line, considerable power will be fed to it, and there is some question as to the value of including a separate dipole for the 15-meter band. The radiation pattern of the 7-Mc. dipole at its third harmonic will be essentially nondirective, although there will be fairly sharp nulls at angles of about 20 degrees with the direction of the dipole wire.

Construction

There are several ways in which the antenna elements can be suspended. W9YPQ suspended one set of elements from the one above it, using insulator-terminated wood spreaders about one foot long. In the author's installation, the elements are simply allowed to droop about two feet, one below the other. Ropes attached to the end insulators are brought back up to a common anchoring point. The elements could also be fanned out, either vertically or horizontally, provided that the angle of fanning does not become too great. The lengths of the elements should, of course, be the same as those for dipoles for each band.

Several other local hams are using this antenna system with excellent results, and much DX has been worked. With a bandswitching transmitter we can hop from band to band as quickly as with the receiver, since there is no need to fuss around with an antenna tuner.[5] Checks with a Millen s.w.r. bridge show that the s.w.r. never exceeds 1.5 to 1 [6] on any of the bands on which the antenna has been operated. These include 40, 20, 15 and 10 meters. Those who have space can add an 80-meter dipole, of course.

[5] This system will, of course, respond to harmonics and submultiples of the output frequency. Therefore more than ordinary care must be used in suppressing these frequencies. — Ed.

[6] Confirming by measurements on a similar system at A.R.R.L. Hq. — Ed.