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TAPERED LINES

This material originally appeared in earlier editions of the ARRL Antenna Book.

A tapered line is a specially constructed transmission line in which the impedance changes gradually from one end of the line to the other. Such a line operates as a broadband impedance transformer. Because tapered lines are used almost exclusively for matching applications, they are discussed in this chapter.

The characteristic impedance of an open-wire line can be tapered by varying the spacing between the conductors, as shown in **Figure 1**. Coaxial lines can be tapered by varying the diameter of either the inner conductor or the outer conductor, or both. The construction of coaxial tapered lines is beyond the means of most amateurs, but open-wire tapered lines can be made rather easily by using spacers of varied lengths. In theory, optimum broadband impedance transformation is obtained with lines having an exponential taper, but in practice, lines with a linear taper as shown in Figure 1 work very well.

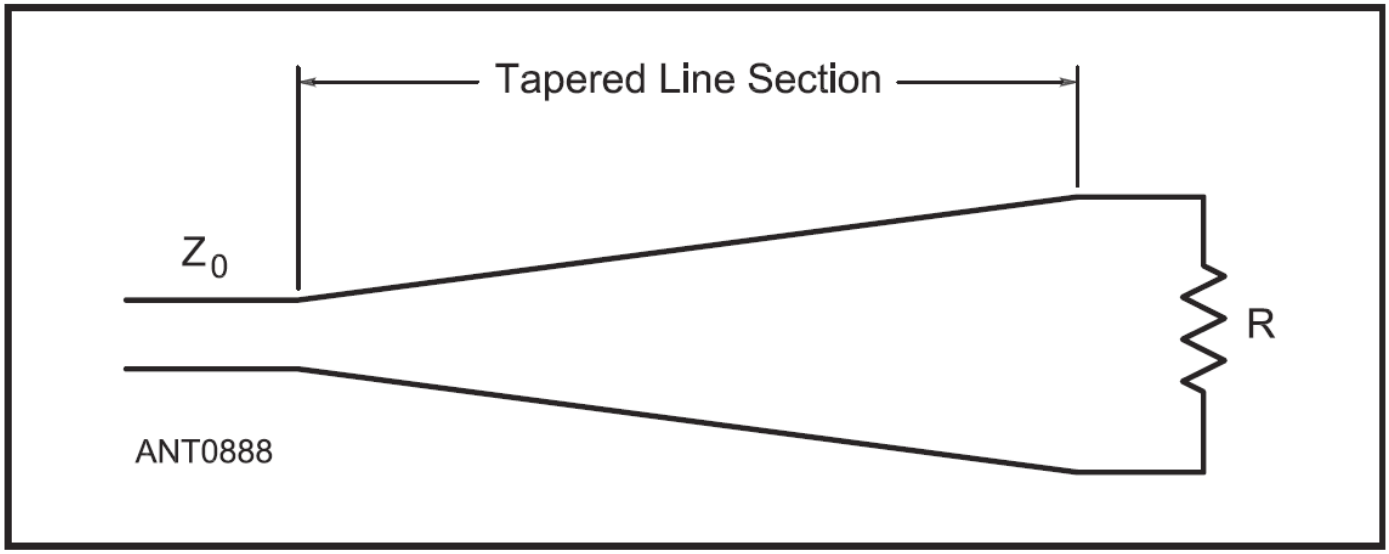

Figure 1 — A tapered line provides a broadband frequency transformation if it is one wavelength long or more. From a practical construction standpoint, the taper may be linear.

A tapered line provides a match from high frequencies down to the frequency at which the line is approximately 1 λ long. At lower frequencies, especially when the tapered line length is λ/2 or less, the line acts more as an impedance lump than a transformer. Tapered lines are most useful at VHF and UHF, because the length requirement becomes unwieldy at HF.

Air-insulated open-wire lines can be designed from the equation

$$S = \frac{d \times 10^{Z_0/276}}{2}$$

where

S = center-to-center spacing between conductors
d = diameter of conductors (same units as S)
Z_0 = characteristic impedance, Ω.

For cases where S < 3d, see the **Transmission Lines** chapter.

For example, for a tapered line to match a 300-Ω source to an 800-Ω load, the spacing for the selected conductor diameter would be adjusted for a 300-Ω characteristic impedance at one end of the line, and for an 800-Ω characteristic impedance at the other end of the line. The disadvantage of using open-wire tapered lines is that characteristic impedances of 100 Ω and less are impractical.