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The radiation pattern of a conical horn. (English summary)

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This paper gives an approximate expression for the field pattern from a conical horn coupled to a cylindrical waveguide. The expression given is based upon the assumption that only the (two-fold degenerate) TE_{11} mode is present in the guide. An approximation is then made that this mode continues to propagate in the horn as a cylindrical Bessel function with zeroes at the walls—though with a quadratic variation of phase with radius, rather than a uniform plane wave-front along the axis of symmetry. This approximation amounts to treating the field as if generated by a point source at the virtual apex of the cone. The field at the aperture is converted into an effective current which is taken to be the source of a free-space vacuum field. The latter is then computed in the dipole approximation.

The output field turns out to be expressible in terms of an integral of a product of two Bessel functions and a Gaussian-type phase factor, and is the main result of this paper. The author recommends evaluation of the integrals numerically—its evaluation as a Lommel series is not given. This approximate output field is compared with a (more exact) numerical simulation. On graphs of intensity versus angle with respect to boresight axis, the author's approximate expression is shown to always agree well with the simulation at small angles, and at larger angles to a degree that depends on the length of the horn compared to the free-space wavelength of the radiation.

Reviewed by *Michael Ibisson*

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