# Penetration through a Slotted Screen into a Dielectric Cylinder Housed in a Semi-Elliptic Channel

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In this paper we consider the problem of penetration of a field through a slotted screen into a dielectric cylinder housed in a semi-elliptical channel adjoined to the screen back. The edges of the slot in the vanishingly thin conducting plane pass through the foci of the semiellipse (of the channel), and the medium inside the channel and that outside are the same or they may be isorefractive to one another. The dielectric cylinder may be of any cross-section. The excitation is either TE or TM to the slot axis and is axially invariant. The excitation is due to a source in front of the slotted screen, or it may be due to a source within the channel. If desired the dielectric cylinder may reside outside the channel or there may be one outside and one inside. We formulate simple coupled integral equations whose solutions are obtained by numerical methods. The solutions of the equations enable one to compute the field in the dielectric cylinder, that in the channel, and that in the region in front of the slotted screen.

The unknowns to be obtained from the solutions of the coupled integral equations are equivalent surface currents. One choice is equivalent electric currents in the case of TM excitation and equivalent magnetic currents in the case of TE excitation. In these coupled equations two classes of Green's functions are employed. One is the simple two-dimensional infinite space Green's function while the other is expressed in series of products of radial and angular Mathieu functions (P. L. E. Uslenghi, IEEE Trans. Antennas. Propagat, 52(6), pp. 1473-1480, June 2004). Physically, for the dielectric cylinder inside the channel, the latter Green's function is the axially-directed field due to a line current in the channel (with cylinder absent).

Solutions of the integral equations are obtained for various cylinder locations and cross-sections, for selected excitations, and for specified channel and slot dimensions. Data are presented for representative cases of interest.