Abstracts

Leakage fields from planar semi-infinite transmission lines (Apr. 1999 [T-MTT])

F.J. Villegas, D.R. Jackson, J.T. Williams and A.A. Oliner. "Leakage fields from planar semi-infinite transmission lines (Apr. 1999 [T-MTT])." 1999 Transactions on Microwave Theory and Techniques 47.4 (Apr. 1999 [T-MTT]): 443-454.

The leakage fields radiated by planar semi-infinite transmission-line currents are studied for two canonical structures: the air-gap stripline and the planar strip of current in free space. The first structure represents a general class of printed-circuit structures where leakage occurs into a substrate mode. The second structure is representative of structures for which leakage occurs primarily into space. It is found that the transverse behavior of the leakage fields for a semi-infinite line differs in significant ways from that expected from an infinite line, a result that is at first surprising, but is understandable on physical grounds, and which is explained by the analysis presented here. The exact leakage fields are compared with two asymptotic approximations: a stationary-phase [geometrical optics (GO)] evaluation, and a uniform asymptotic expansion (UAE). The UAE solution is the more accurate one, and accounts for diffraction-like effects that arise due to the semi-infinite nature of the line. One conclusion is that the observation distance must be very large for the true leakage fields to closely resemble the GO fields, although a quasi-GO behavior may still be evident at shorter distances, depending on the value of the leakage angle. Another conclusion is that the transverse behavior of the GO leakage field of the printed-circuit structure is an exponentially increasing field within the leakage region, as expected from a simple ray-optics picture, while it is not for the strip in free space.

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