Abstracts

Analysis and development of millimeter-wave waveguide-junction circulator with a ferrite sphere

E.K.-N. Yung, R.S. Chen, K. Wu and D.X. Wang. "Analysis and development of millimeter-wave waveguide-junction circulator with a ferrite sphere." 1998 Transactions on Microwave Theory and Techniques 46.11 (Nov. 1998, Part I [T-MTT]): 1721-1734.

This paper presents a class of new easy-to-fabricate ferrite-sphere-based waveguide Y-junction circulators for potentially low-cost millimeter-wave applications. A new three-dimensional modeling strategy using a self-inconsistent mixed-coordinates-based modal field-matching procedure is developed to characterize electrical performance of the proposed circulator. It is found that the circulating mechanism of the ferrite-sphere post is different from its full-height ferrite counterpart in that the new structure operates in a turnstile fashion with resonant characteristics, while the conventional device operates on a transmission cavity model. Extensive comparable studies between the new and conventional circulators are made to show that the electrical behaviors of the new structure are also distinct and radial power-density profiles are not stationary, as in the case of the full-height ferrite post circulator for different geometrical parameters. Results obtained by the analysis technique are compared with the available results for a full/partial-height ferrite circulator, showing an excellent agreement. Our calculated and measured results are also presented for W-band circulators with the proposed ferrite-sphere technique, indicating some interesting characteristics such as the frequency offset behavior of the isolation and reflection curves. In addition, radial power-density profiles are plotted inside and outside the ferrite sphere to illustrate its intrinsic circulating mechanism, as well as its difference, as compared to its full-height ferrite structure.

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