# MODE-MATCHING ANALYSIS OF AN EBG QUASI-TEM CONICAL HORN REALIZED BY STRIPS AND VIAS

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The last decade is characterized by growing interest in research of electromagnetic bandgap (EBG) structures for application in waveguides and horns capable to support the quasi-TEM mode having a uniform field distribution over the cross-section. This feature can be effectively used for development of horn antennas and feeds with high aperture efficiency and low cross-polarization. The quasi-TEM horn exciters also allow enhancing the performance of the quasi-optical grid amplifiers.

A promising realization of the EBG structures for the quasi-TEM horns is a so called hard wall based on an internal dielectric cover loaded with narrow longitudinal strips connected by vias to the basic metallic wall. The purpose of this work is numerical analysis of the horn with the indicated wall, since such a design is of definite practical interest, however its properties have not been studied yet before.

The analysis is based on the mode-matching method, which allows accounting for all the effects associated with the wave propagation and scattering in the horn. The first stage is the representation of the conical surfaces by stepped surfaces formed by a set of cylindrical sections with appropriate flanges. We use a combined hard wall model, where the strip-loaded sections alternate with the longitudinally corrugated sections representing the vias. Further, the mode-matching method is used for calculation of the generalized scattering matrix for each step. The necessary eigenmodes of the strip-loaded and corrugated sections are determined with using the corresponding asymptotic boundary conditions that significantly simplify the analysis. The scattering matrices of the steps are subsequently used for calculation of the scattering matrix of the stepped transition as a whole. The latter matrix together with the open-ended waveguide characteristics calculated with using the factorization method are used for determining the horn reflection coefficient, radiation pattern, aperture efficiency, and cross-polarization level.

In the work, we present the calculated characteristics of the hard strip-loaded horn with vias, discuss the effect of the different parameters of the model, and compare the features of this hard horn with hard horns of other types.