

# Realisation and Optimization the System of Ridge Waveguide Polarizer by Genetic Algorithms for Telecommunication Satellite Antennas

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## Summary

The ridged waveguide polarizer is considered as the better way to get right-hand and left-hand circular polarization in the antennas of telecommunications satellites. In fact, it is a system of three ports used to feed a square waveguide antenna in order to achieve high purity in the right-hand and left-hand circular polarization. Obtaining a great purity of polarization results by the addition from screw from adaptation and blades from correction. A solution with this problem is obtained by the optimization of dimensions of the various ridges. The object of work consists in determining optimal dimensions of the ridges of the polarizer by using the "Genetic Algorithms". The structure is modeled in 3 dimensions then simulated and optimized in order to obtain a  $90^\circ$  phase shift between the two orthogonal components in the system output and this in the waveband [11-13] GHz. The results of simulation and optimization are outlined using the HFSS software.

**Keywords:** Polarizer, Ridged waveguide, Simulation, Optimization, discontinuities.

## 1. Introduction

The polarization properties of the fields and the antennas are naturally the first concerned in any problem treating the communication between satellite antennas. The receive antenna power varies from maximum value to the zero according to the field polarization state. Thus the use of the polarizer in the transmitting or receiving antennas is necessary. In general the systems of antennas require fields with circular polarization [1], [2]. This is so that the re-use of the wave in two orthogonal polarizations makes decrease the occupied waveband. The installation of a polarizer making it possible to re-use the same antenna in two right and left circular polarizations involves the reduction in the weight and the obstruction of the satellite compared to a solution including two antennas [3]. In this article, we are interested in the synthesis of the ridged waveguide by the use of a method of stochastic optimization based on the genetic algorithms, in order to determine optimal dimensions of the ridges [4]. The

analysis of the polarizer based on the determination of the various parameters-S [5], the coefficients of reflection of entry of modes  $TE_{10}$  and  $TE_{01}$  as well as phase shift of  $90^\circ$  between the two orthogonal components [6] of the electric fields. The results of simulations and optimization by software HFSS are presented and discussed.

## 2. Ridge waveguide polarizer

### 2.1 Characteristics of ridge waveguide polarizer

The ridged guides (figure1) have a low impedance of wave, which makes it possible to achieve good transitions with the planar lines of transmission; they have a broad band-width and a cut-off frequency of the rather low fundamental mode allowing the realization of the components of reduced size and less cumbersome, therefore more compact. In spite of a rather important attenuation and a limited transported power due to the multipactor effect in the area of the gap, the ridges guides are used in many microwaves applications and in particular in the realization of the filters with evanescent modes and the food for the satellites antennas.

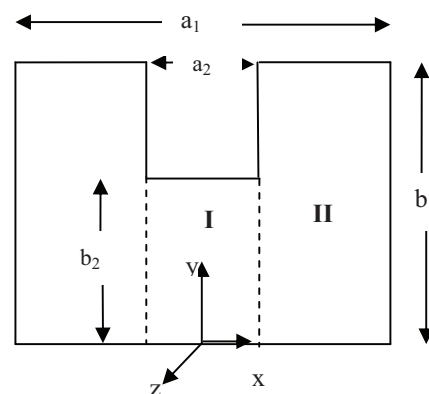


Fig. 1 transversal Coupe of the ridged waveguide.