ON-SUBSTRATE RESONANT CAVITY.

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ABSTRACT

The resonant frequency of the circular cross-sectional FR4-filled cavity is studied and presented in this paper. The cavity model is designed within the two layers of the FR4 substrate with the permittivity of 4.1. The feed lines are located between the two layers of the substrate while the circular cavity is surrounded by the metallic via. The dimensions are set such as to have a fundamental resonant frequency at about 4.610 GHz. Dominant TM_{010} and TE_{111} modes wave are excited into the cavity to give various value the resonant frequency depending on the radius of the circular cavity. The simulation results show that the resonant frequency of the cavity resonator decreases dramatically as the radius of the circular cavity increased for TM_{010} mode. Differ to the TE_{111} mode which is resonant frequency decreased slightly as the radius of the circular cavity increased. The best radius of the circular cavity is found to be 12.3mm, giving the closest resonant frequency to the one desired. The metallic via around the circular plate is to emulate the metallic wall a normal cavity where their distance is kept minimum to reduce leakage loss through giving the clear resonance variation. The works show very close agreement between the result from simulation and the measurement. The success of the project may lead to the possibility of using planar structure to emulate resonant cavity for filters.

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

The cavity resonator has the form of a volume filled with a dielectric-air, in most cases. The volume is bounded by a conducting surface or by a space having differing electrical or magnetic properties. Hollow cavity resonators cavities enclosed by metal walls are most widely used. The boundary surface of a cavity resonator can have an arbitrary shape. But only a few very simple shapes are used because such shapes simplify the configuration of the electromagnetic field and the design and manufacture of resonators. These shapes include right circular cylinders, rectangular parallelepipeds, toroids, and spheres. It is convenient to regard some types of cavity resonators as sections of hollow or dielectric wave guides limited by two parallel planes [1]-[2].

Cavity commonly used in microwave, millimeter wave and optical fibers. A resonant cavity is a device having an enclosed volume bounded by electrically conductive surfaces and in which oscillating electromagnetic fields are sustainable. Resonant cavities are simply structures that allow the build-up of standing waves. The circular cavity can only be analyzed conveniently using the cavity model [3], [4], [5]. This can be accomplished using a procedure similar to that for the rectangular patch but now using cylindrical coordinates [6].

The dielectric material of the substrate is assumed to be truncated beyond the extent of the patch [7]. To find the fields within the cavity, we use the vector potential approach.