# BANDWIDTH ENHANCEMENT OF CIRCULAR MICROSTRIP PATCH WITH PHI SHAPE GAP COUPLING SLOT BY VARYING AIR GAP

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## Abstract

In this Paper, the performance of a circular microstrip patch with phi shape gap coupling slot geometry is tested under different conditions and efforts are made to obtain further improved antenna for practical applications. The bandwidth of modified antenna improved significantly. Direction of maximum intensity is retained normal to patch geometry but efficiency values of antenna were very low. In the first step, the substrate thickness is increased and in the second step, air gap between the substrate materials is introduced. With the introduction thick substrate, effective radius of antenna decreases which in turn increases the resonance frequency of antenna. Since our aim was not to increase the resonance frequency to a large extent therefore we simultaneously introduced air gap between the two substrate materials. Due to this insertion, effective dielectric constant of the substrate material reduced and in turn the resonance frequency decreased.

The obtained results suggest that the bandwidth of circular microstrip patch with phi shape gap coupling slot geometry is around seven times higher than that of a simple circular patch antenna and direction of maximum radiations is normal to the patch geometry. The gain and efficiencies of modified circular patch antenna are much higher than a simple circular patch antenna.

**Keywords:** Broad Band, Gap Coupled, Phi Shape Ring Slot, Varying air gap

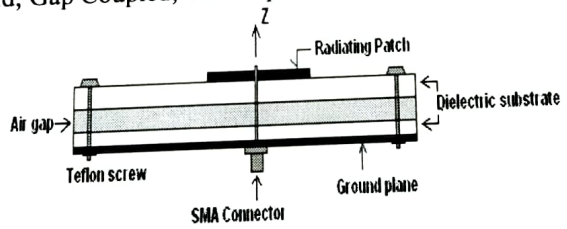


Figure (1): Side view of application of air gap in microstrip antenna patch geometry

## I. INTRODUCTION

We realized that the major limitation of microstrip antennas is their narrow bandwidth (of the order of few percent) and it can be improved by making necessary alteration in the patch geometry. Almost every time, the factor that limits the bandwidth of patch antenna is its impedance behaviour. Many efforts have gone into broadening of impedance bandwidth of these antennas. Some has involved attempting to realize the maximum bandwidth through better matching techniques while others approaches broaden the bandwidth by using multiple elements that are either directly or parasitically coupled to the original patch.

The bandwidth is determined by the patch physical size. One way to increase bandwidth of antenna is to increase its size. For a single element, the size can be increased by making the antenna longer, wider or thicker. The patch length is fixed by the requirement to be resonant.

It can be lengthened only by lowering the substrate dielectric constant, which is usually desirable because of reduced surface wave excitation. Increasing the patch width is possible as long as it

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# Dual Frequency Dual Band OM Shape Microstrip Patch Antenna for Wi-Max Applications

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## ABSTRACT

This paper presents the Novel Om shape antenna for Wi-Max Application using the alumina substrate. In this design the Om shape is created by the rectangular patch of size L= 26mm, W= 34mm and fed by single probe fed. By varying the fed point position and area of Om patch in the rectangular microstrip patch, this antenna resonates for medium band of Wi-Max application at frequencies 3.56 GHz and 3.78 GHz and for higher band of Wi-Max application at frequencies 5.31 GHz and 5.74GHz also presents a relatively higher broad bandwidth (13.7% at central frequency 3.7GHz and 29.25% at central frequency 5.20 GHz. By designing antenna on low permittivity substrate, a much higher performance may be achieved.

**Key words:** Microstrip antenna, Shorted patch antenna, Shorting –pin loaded antenna, Multi-frequency antenna, Wi-Max Application.

## I. INTRODUCTION

Microstrip antennas have found extensive applications in satellite, mobile and wireless communication systems due to their attractive features like their small size, lightweight, low profile and conformability on host surface. Extensive analysis of different geometries of microstrip antennas including rectangular, circular, triangular and square-ring shapes has been carried out but in practical applications circular and rectangular geometries are more widely analyzed due to their simple geometries. It has been found that a patch antenna having regular shape resonates only at a single resonance frequency and has very poor bandwidth (1 to 2%) [1-3]. Recent advancements in wireless communication systems particularly in wireless data communication and cellular phones, has increased the demand for wide band, multi frequency and multi band patch antennas.

Microstrip antennas for dual frequency applications may be realized by exciting patch geometry by using a single [4] or dual feed [5].

In this paper we propose a rectangular patch microstrip antenna with star slot. The antenna is simulated with available e.m. simulation tool using alumina substrate having relative dielectric constants $\epsilon r = 9.8$, loss tangent $\tan\delta = 0.0004$ and