

# Slotted Circular Shaped Wide Band Antenna for Wi-Max Application

Devi Perla, Rajya Lakshmi Valluri

**Abstract:** In this paper, Circular shaped Micro strip patch antenna is designed for wide band and to improve the performance of an antenna and applicable for Wi-MAX, a slot is placed on a circularly shaped microstrip patch antenna. FR4 substrate with a relative permittivity of 4.4 and strip line feed is used. When compared to conventional patch antenna, the slotted antenna has better return loss of -35dB and a gain of 5dB. HFSS (High Frequency Structure simulator is used for designing and simulation of results.

**Index Terms:** Microstrip Patch antenna, Wi-MAX, HFSS, Wide Band.

## I. INTRODUCTION

Due to high increase in demands for wireless communication systems, instead of using several antennas for various applications, a single Wideband antennas is used. This antenna will give better return loss for wide band of frequencies. The advantages of using these wideband antennas are large bandwidth, high gain, low cost, cost, high data rates and high complexity and it is used in different applications such as radar, imaging in medicine and military communication. Wide band antenna can be designed in several ways, by using different patch shapes like triangular patch, hexagonal patch, circular and rectangular etc. Several methods are used to enhance its bandwidth (BW) by using parasitic structures, defected ground plane and other different arrangements. A loop antenna with unequal sides of octagonal shape closed with the loop capacitance. Both the ends of the loop antenna are connected to the capacitance. By changing the capacitance of the loop, the frequency operation of the loop is changed [1]. A rhombus shaped antenna is used coplanar wave guide feed. This antenna used natural rubber as a substrate to achieve wide band [2]. A square patch antenna achieved ultra wide band by placing the slots on the patch and the feed line [3]. A multilayer configuration antenna consists of three rectangular patches. One patch is on the bottom layer and other two patches are on top layer. The bottom patch is only fed and other two patches are coupled electromagnetically [4]. A circular ring antenna used defected ground structure and it was fed strip line feed to achieve wide band [5]. A planar antenna consists of bevelled rectangular patch and it is used partial ground to get multi resonance modes [6]. A rectangular antenna comprises stepped slot

achieved wide band characteristics by changing the feed position and dimensions of the slot and feed [7]. In view of above observations a circular patch antenna is designed for wide band operation. In order to applicable for Wi-MAX application, the patch is slotted. This slotted patch has given better return loss and gain when compared to the circular shaped antenna.

## II. ANTENNA DESIGN

The antenna consist of circular patch, it was placed on FR4 substrate 50mmx42mmx1.6mm with a substrate thickness of 1.6mm, loss tangent 0.02 and dielectric constant 4.4. To this circular patch antenna strip line feed is given. The Fig.1 shows the circular patch antenna and it side view. High Frequency Structure Simulator (HFSS) software is used to design and analyse the antenna. The dimensions of the design are tabulated in table 1.

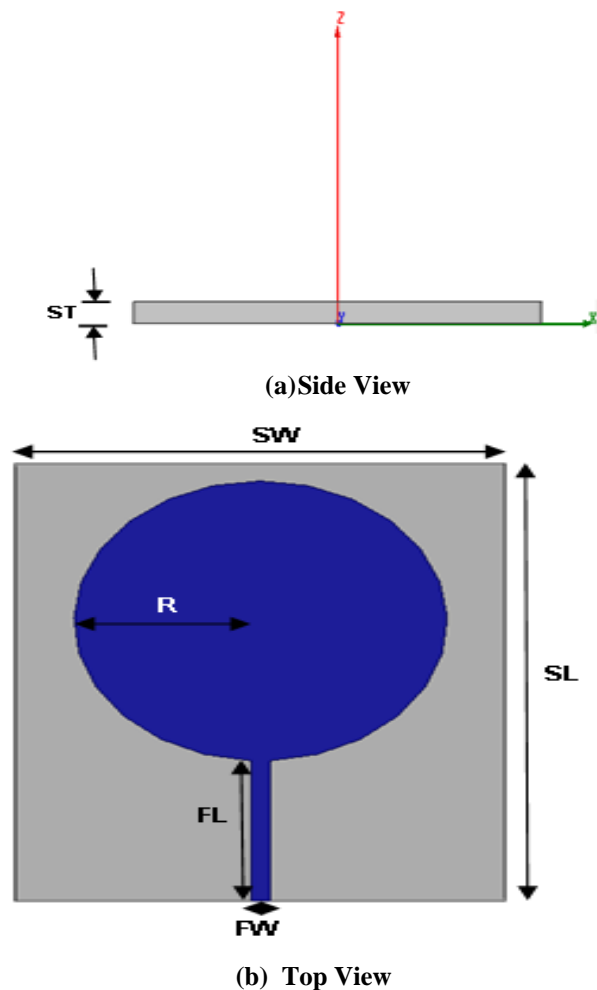


Fig.1. Circular Patch Antenna

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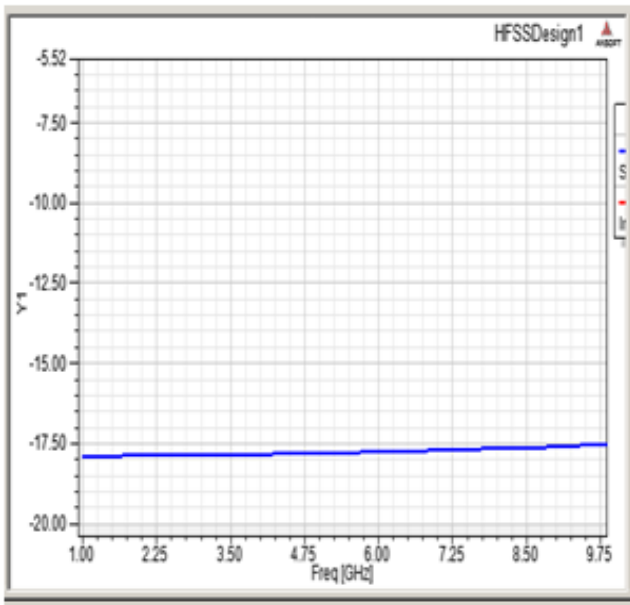
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## Slotted Circular Shaped Wide Band Antenna for Wi-Max Application

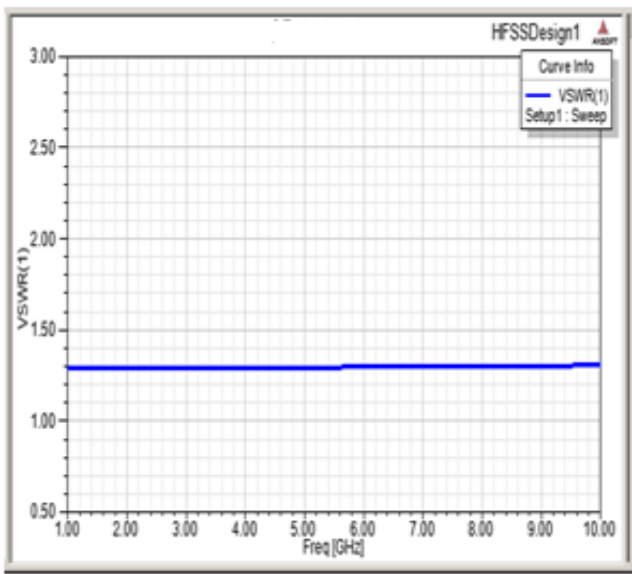
**Table.1. Dimensions of Circular Patch Antenna**

S. No	Parameter	Description	Dimension
1.	SL	Substrate length	50mm
2.	SW	Substrate width	42mm
3.	ST	Substrate thickness	1.6mm
4.	FW	Feed line width	1.6m
5.	FL	Feed line thickness	16mm
6.	R	Radius of the circular patch	16mm

The circular patch antenna is having approximately same return loss for all the frequencies, i.e. -17.5dB with a VSWR of 1.3; this antenna is suitable for wide band applications because it more allowable bandwidth. In this case, the entire design is having a return loss of -17dB approximately for all the frequency range. The Fig.2 shows the return loss plot and the VSWR plot is shown in Fig.3.

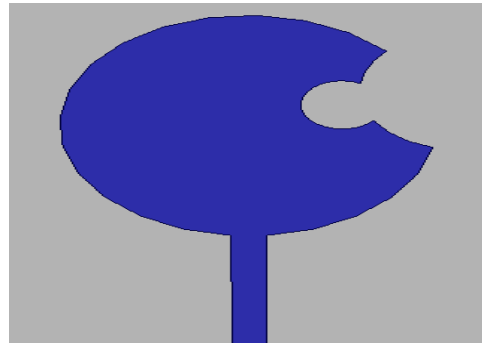


**Fig.2. Return Loss Plot of Circular Patch Antenna**



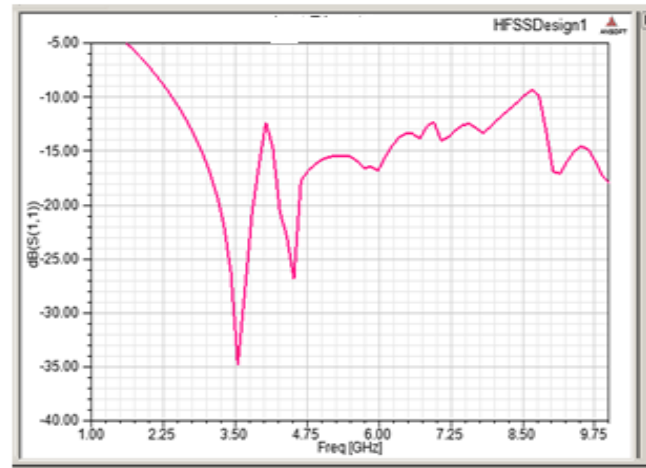
**Fig.3. VSWR Plot of Circular Patch Antenna**

In order to improve the performance of an antenna in terms of its return loss, VSWR, gain and to useful for Wi-MAX applications. The circular patch is slotted, this antenna is useful for Wi-MAX applications and it has better return loss and gain values when compared to previous circular shaped patch antenna. The proposed slotted circular antenna is shown in Fig.4.

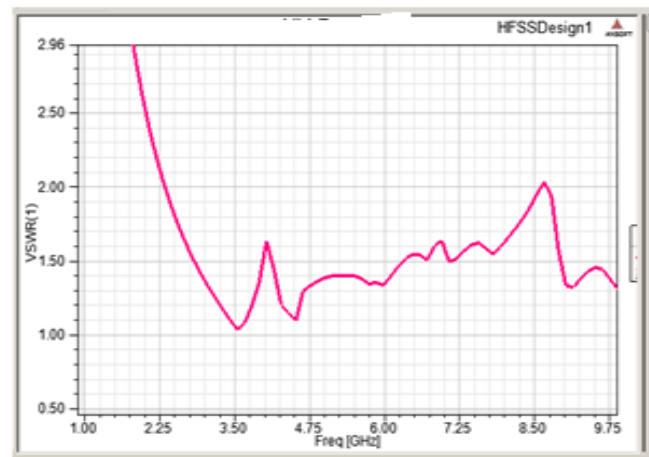


**Fig.4. Proposed Slotted Circular Antenna**

The proposed antenna is having a return loss of -35dB at 3.5GHz and the return loss plot is shown in Fig.5. In this case, the design is applicable for Wi-MAX application, because the design is resonating at 3.5GHz frequency. The VSWR vs frequency plot is shown in Fig.6, the proposed design is having a VSWR of 1.05 at 3.5GHz.



**Fig.5. Return Loss Plot**



**Fig.6. VSWR plot**

Slotted circular antenna is having a gain of 5.39dB, the 3D gain plot is shown in Fig.7 and E-plane and H-plane radiation pattern plots are shown in Fig.8. The parameters of the proposed slotted antenna are shown in Table.1

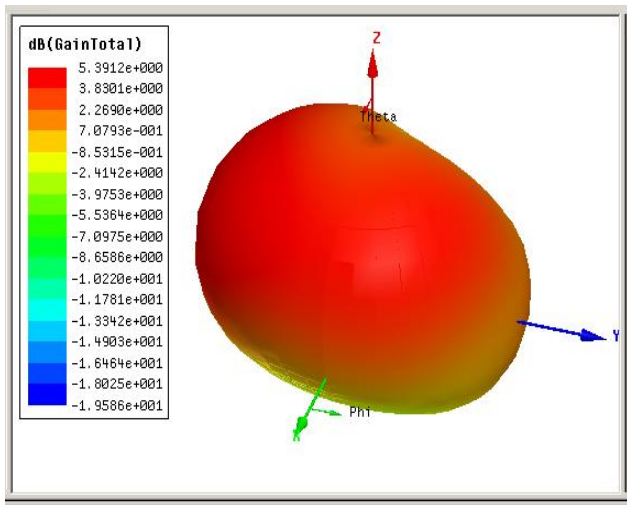


Fig.7.3D Gain Plot

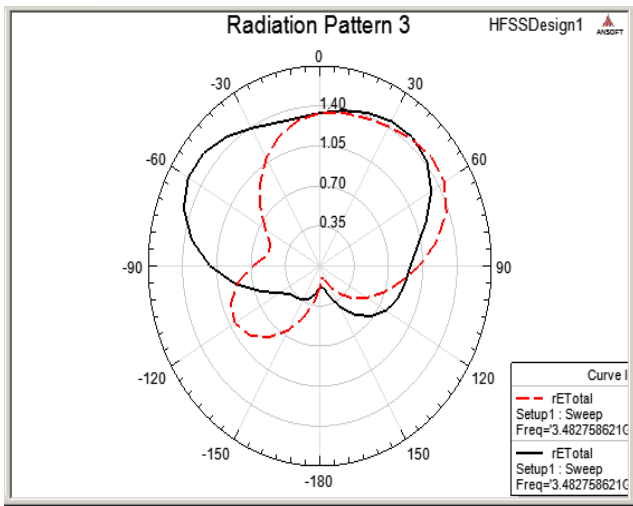


Fig.8. Radiation Pattern Plot

Table.1: Parameters of Proposed Antenna.

Parameters	Values
Return Loss	-35dB
VSWR	1.05
Gain	5.39dB
Bandwidth	7GHz

III. CONCLUSION

The proposed slotted circular patch antenna achieved wide band characteristics with a bandwidth of 7GHz and it is resonating at a frequency of 3.5GHz with a return loss of -35dB, VSWR of 1.05 and gain of 5.39dB. This design is useful for Wi-MAX application.

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