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Design Techniques of Microstrip Patch Antennas: A Comprehensive Survey

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ABSTRACT: ***This paper describes a survey on the microstrip antennas and there historical perspectives. The microstrip antennas have been spaciously studied in the last few decades as one of the standard planar antennas.The microstrip antennas are commonly used in radar and wireless communication systems because they assent pliable orientation of the transmitter and the receiver. Most of them cannot be employed in ultra-wideband (UWB) applications because of their narrow circularly polarized radiation (3-dB axial ratio) and impedance bandwidths. The microstrip patch antenna also have a great possibility for further developments. These antennas are being widely used day by day for various applications in wireless communication systems, GPS and many more applications because of their operation in dual frequency mode or multi-band operations. This survey paper provides a detailed review on the microstrip patch antennas.***

KEYWORDS:Communication System, Global Positioning System (GSM), Microstrip Patch Antenna, Patch Antenna, Wideband Antenna.

INTRODUCTION

Microstrip antenna in its basic form consists of four parts (metallic patch, dielectric substrate, ground plane and feeding structure) as shown in Figure 1[1]. Where L is the length of the patch, W is the width of the patch, h is the dielectric substrate height and $\mathcal{E}_r$ substrate relative permittivity. Often microstrip antennas are also referred to as patch antennas[2].

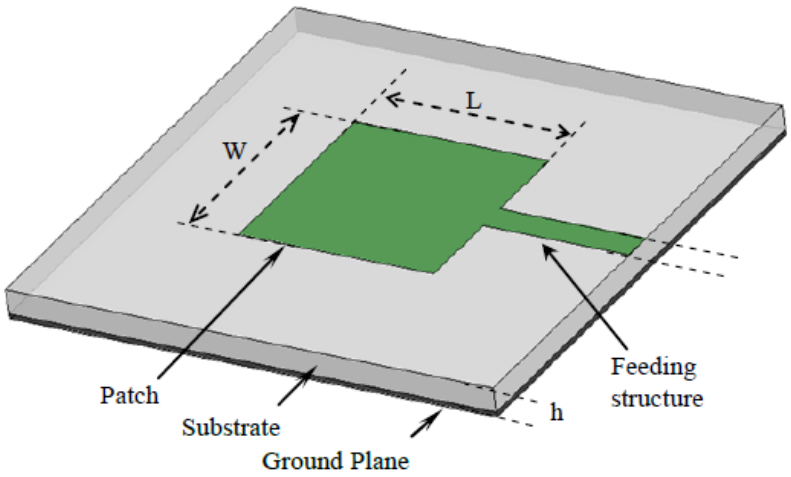

Figure 1: Illustrates basic microstrip antenna[3].

Recently, wireless communication and GPS systems have forced the use of circular polarization, since circularly polarized radiations offer numerous advantages. The fundamentaladvantages of circular polarization are its huge penetrationcapability compared with linear polarization and its ability ofestablishing a reliable signal link irrespective of the antennaorientation of the device[4].Because of their size, the microstrip patch antenna is often used in modern communication devices over traditional antennas[5]. In this review paper, a study is carried out on commonly used techniques and designs used in microstrip antenna papers used by authors to design an effective, low-profile, small, compatible, affordable microstrip antenna, mainly used for reconfigurable, multiband and wideband antennas, after which an initiator patch design is given with dimensions on which these techniques will be used[6].Table 1 shows comparative analysis of different techniques.

Table 1: Illustrates comparative analysis of different techniques.

Sl.	Antenna	Techniques	Remark
1.	Implementation of Slotted Meander Line Resonators for Isolation Enhancement in microstrip	A Defect is introduced called as meander line resonator by creating defect known as band notch function. Resonator is designed to block surface current at resonant frequency of two patch antenna	To enhance isolation in microstrip patch antenna arrays and it has concluded that that technique only implemented on array antennas.
2.	Wide Band Dual-Beam U-Slot microstrip Antenna	Bandwidth of antenna is obtained by making use of u shaped patch. Conventional U slot patch antenna, parametric analysis is analysed.	The proposed design was used for stationary terminals of various indoor wireless communication networks.
3.	Circular symmetric slotted microstrip patch antenna with compact size	Obtained by cutting shapes in diagonal directions of microstrip patch antenna.	3 dB axial-ratio (AR) bandwidth of around 0.7% (6.0 MHz) with 2.0% (18.0 MHz) impedance bandwidth was achieved
4.	Triband bowtie antenna using slot technique	Obtained by inserting two pairs of slot with different length of isosceles triangle without increasing area of triangle.	Antenna was resonated at three different bands but its dimensions were made for middle frequency band. This antenna was

LITERATURE REVIEW

This section provides a brief review of the past work in the antenna field. The theoretical and experimental work in different types ofmicrostrip antennas around the world is illustrated. This chapter briefly describes various developments in the circularly polarized

microstripantennas and also deals with recent trends in dual band microstrip patch antennas design in modern communication systems[7].Papers related to microstrip patch antennas are chosen and studied.

Dual-Band circularly polarized S-shaped slotted patch antenna with a small frequency-ratio has been purposed by Nasimuddin *et al*. In this letter,S-shaped slot is dig at the centre of a square patch radiatorfor dual-band operation. A single microstrip feed-line is underneaththe centre of the coupling aperture ground-plane. The frequency-ratioof the antenna can be controlled by adjusting the S-shaped slot armlengths. The measured 10-dB return loss bandwidths for the lower andupper-bands are 16% (1.103–1.297 GHz) and 12.5% (1.444–1.636 GHz),respectively[8].

DISCUSSION AND CONCLUSION

Antennas are necessary and critical components of communication and radar systems. One of the breakthroughs is that only one system could support several applications on various frequency bands or polarizations and the system requires separate antennas in order to support different applications. At times their inability to adjust to new operating scenarios can limit system performance. Making antennas reconfigurable so that their behaviour can adjust with changing system requirements or environmental conditions eliminate these restrictions and provide additional levels of functionality for any system.

This paper is survey on the design methods and techniques for microstrip patch antenna. The technology used and research work increases the use of Micro strip antenna and their performance day by day and also make better utilization in future. Various techniques improve gain and bandwidth of the Micro strip Antenna. Due to this survey effect disadvantages of microstrip patch antennas can be minimized. Array configuration can overcome the Low gain and power handling capacity. The feeding techniques also improve their performances. There are many simulation software are developed for micro strip antenna which make simple and accurate designing in proper, accurately and in automatic way with eliminating all complexity.

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