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A Literature Survey on Microstrip Rectangular Patch Antenna for Ultra Wide Band

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***Abstract*- In the current generation microstrip patch antenna was planned at variety of substrate plane (partial, triangular, elliptical, and circular) for different result analysis of gain and directivity. In this communication grow of the Wi-Fi and Wi-max in wireless communication, multi band microstrip patch antenna plats a major player of the sector. Wireless local area network (WLAN) and Worldwide Interoperability for Microwave Access (WiMAX) have been used in the different communication sector in mobile as well as radio internet communication. In this survey paper shows the review of different ultra wide band (UWB) based antenna for different band rectangular patch antenna for WLAN and WiMAX application with variety of substrate, In this paper we also discuss the basics of microstrip antenna, various feeding techniques, design model and antenna parameters used in antenna design.**

Keywords—Microstrip Patch antenna, Wifi, Wi-Max, UWB and substrate.

I. INTRODUCTION

Microstrip patch antenna is widely used in wireless communication because of its several advantages like low profile, low cost, planar structure and easy integration with printed circuit board. These features make the microstrip antenna very attractive for use in high-speed vehicles, such as missiles, rockets and satellites. But it has some draw back like low gain, low impedance bandwidth and less power handling capability [4-11]. The geometry of a microstrip antenna contains conducting patch on the top of a substrate, which is backed by a ground plane. The shape of patch can be arbitrary. But in practice, regular shapes like rectangular, circular and the annular ring are used for easier analysis. In this era of next generation networks we require high data rate and size of devices are getting smaller day by day. In this evolution two important standards are Wi-Fi (WLAN) and WiMAX. For success of all these wireless applications we need efficient and small antenna as wireless is getting more and more important in our life. This being the case, portable antenna technology has grown along with mobile and cellular technologies. Microstrip antenna (MSA) has characteristics like low cost and low profile which proves Microstrip antenna (MSA) to be well suited for WLAN/WiMAX application systems.

II. ANTENNA PARAMETERS

There are different parameters of antenna which are utilized to examine the efficient functioning of the antenna. The following are the few antenna parameters:

2.1.Return Loss:

It is the power loss in the signal that is reflected due to discontinuity in the transmission line. As we already know, when impedance matching between the transmitter and antenna is not perfect, the radiations within the substrate results into the standing waves. As a result the return loss is the criteria similar to VSWR that indicates the perfect impedance matching between the transmitter and the antenna. The return loss is formulated as

$$RL = -20 \log_{10} (Pi/Pr) \quad (2.1)$$

Where Pi =Incident power
Pr= Reflected power

2.2.Smith Chart:

It was created by Phillip H. Smith and is a wonderful tool for viewing the impedance of the transmission line and antenna working as a function of frequency. They are exceptionally advantageous for impedance matching. The complex reflection coefficient denoted by $\acute{\Gamma}$ for the load impedance ZL attached to the transmission line with characteristic impedance Z0 is represented by:

$$\acute{\Gamma}= (ZL- Z0) / (ZL+Z0) \quad (2.2)$$

We represent all the values of $\acute{\Gamma}$ on the real and imaginary axis. The center point denotes the point where the reflection coefficient is zero.

2.3. Voltage Standing Wave Ratio (VSWR):

It states that how well the matching takes place between antenna and transmission line and the receiver which illustrates the maximum energy transfer. Imperfect impedance matching results into reflected back waves approaching the transmitter. The interplay between the reflected waves and the forward waves results into standing waves.

$$VSWR= (1+ \acute{\Gamma}) / (1- \acute{\Gamma}) \quad (2.3)$$

Where $\acute{\Gamma}$ =Reflection coefficient

Ideally, VSWR =1 is perfectly matched, that is no power is reflected back.

2.4. Directivity:

The measure of directionality of an antennas radiation pattern is known as directivity. An antenna which radiates evenly in every direction has directivity equal to 1 or 0 dB. It is also defined as the radiation intensity in a given direction from the antenna divided by the radiation intensity averaged over every direction. Analytically, it is represented as –

$$D = U / U_0 = 4\Pi U / P_{rad} \quad (2.4)$$

U = radiation intensity (power density per unit solid angle)
U0 = radiation intensity of isotropic source (power density per unit solid angle)
P_{rad} = total radiated power (W)

2.5. Gain:

It is relative measure of an antennas ability to direct RF energy in particular direction. It is defined as how much power is transmitted in the direction of peak radiation to that of an isotropic source. Mathematically it is be represented as

$$Gain = 4\Pi U/Pin \quad (2.5)$$

U = radiation intensity
Pin = total input power

III. Literature Survey

There are different researcher of research work done in the field of Microstrip patch Antennas for increasing the Gain, Bandwidth and Directivity of the antenna. The papers used as reference for the designing of my work are as follows:

The concept chosen in simulation design of Antenna, is should be increased gain and much bandwidth should be achieved in results. The paper selected by me for these concepts is "Dual-band h-shaped slot antenna for 2.4 GHz and 5 GHz wireless communication". The aim of this work is gain enhancement of MSA without degradation of bandwidth. This paper describes the increase of UWB more than 3dB over a wide impedance bandwidth by using a simple rectangular patch placed above the substrate. The electrical size enhancement is responsible for this UWB improvement. Bandwidth by using a simple rectangular patch placed above the substrate. The electrical size enhancement is responsible for this UWB improvement.

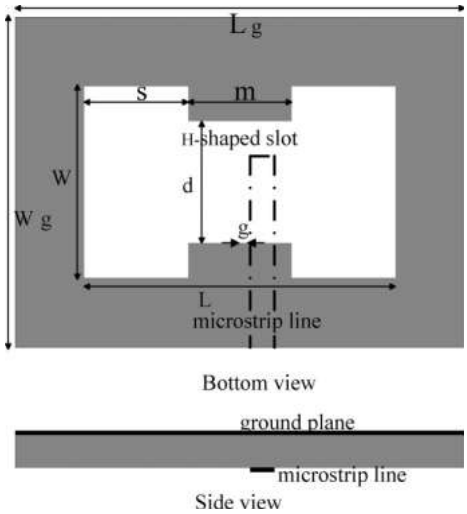

Figure 2.1 Geometry of the proposed slot antenna

The research paper entitled "Compact and Small Planar Monopole Antenna with Symmetrical L- and U-Shaped Slots for WLAN/WiMAX Applications." Authors are Mahdi Moosazadeh and Sergey Kharkovsky, *Fellow, IEEE* shown the Dielectric resonators using high-permittivity materials. A small and compact triple-band microstrip-fed printed monopole antenna for Wireless Local Area Network (WLAN) and Worldwide Interoperability for Microwave Access (WiMAX) is presented.

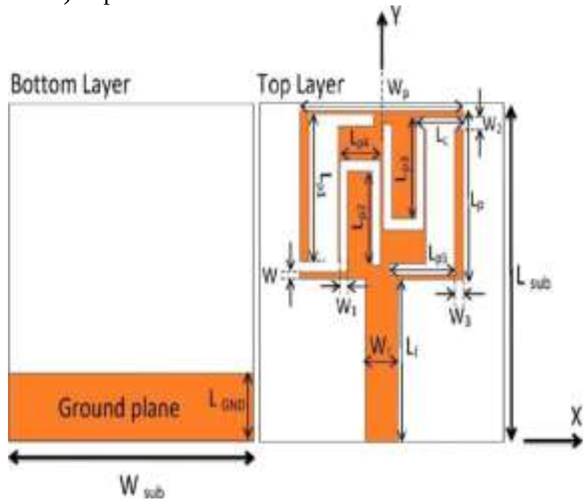

Fig. 2.2 Configuration of the proposed antenna.

The proposed antenna consists of a rectangular radiating patch with L- and U-shaped slots and ground plane. A parametric study on the lengths of the U-shaped and L-shaped slots of the proposed antenna is provided to obtain the required operational frequency bands-namely, WLAN (2.4/5.2/5.8 GHz) and WiMAX (2.5/3.5/5.5 GHz). Omni directional radiation pattern and acceptable antenna gain are achieved over the operating bands.

The research paper entitled "CPW-fed Slot Patch Antenna for 5.2/5.8GHz WLAN Application **"In microwave**

and millimeter wave applications, slot antennas fed by coplanar waveguide (CPW) are receiving increasing attention". In this paper, a CPW-fed patch antenna with slots is presented. The antenna consists of patch structure with two rectangular slots on it. The physical size of the proposed antenna is 30mm * *24 mm.* Antenna was designed on a polygon poly guide substrate with dielectric constant = 2.32 and thickness of 1.59 mm. The impedance bandwidth of the proposed antenna is 4.1 GHz ranging from 4.8 GHz to 8.9 GHz and has a fractional bandwidth of 60%. The proposed CPW-fed slot patch antenna produces a 30% higher bandwidth compared to the conventional CPW-fed patch antenna. The antenna is resonating at 5.5 GHz and gives monopole radiation pattern at this frequency. This antenna can be used in 5.2 GHz/5.8 GHz WLAN application.

The research paper entitled **"Planar multi-band t-shaped monopole antenna with a pair of mirrored l-shaped strips for WLAN/WiMAX operation"** whose publishers are J. H. Lu and Y. H. Li given compact design of planar T-shaped monopole antenna with multi-band operation for WLAN/WiMAX system is proposed. By insetting a pair of mirrored L-shaped monopole strips, multi resonant modes close to 2.45/3.5/5.5 GHz band are excited to meet the specifications of WLAN/WiMAX system. And, the obtained impedance bandwidth across the operating bands can reach about160/1100/2690MHz for the 2.45/3.5/5.5 GHz bands, respectively. Only with the physical size of antenna (30*42*0.8 mm3), the proposed monopole antenna has operated at very high frequency. The measured peak gains and radiation efficiencies are about 3.2/3.5/5.4 dB and 72/98/96% for the 2.45/3.5/5.5 GHz band, respectively,

IV. ADVANTAGES AND DISADVANTAGES

The MSA has proved to be an excellent radiator for many applications because of its several advantages, but it also has some disadvantages.

Advantages

- MSA has several advantages compared to the conventional microwave antennas. The main advantages of MSA is listed as follows:
- It is a lightweight and has a small volume and a low-profile planar configuration.
- It can be made conformal to the host surface.
- Their ease of mass production using printed-circuit technology leads to a low fabrication cost.
- It is easier to integrate with other MICs on the same substrate.
- It allows both linear polarization and CP.
- It allows for dual- and triple-frequency operations.

Disadvantages

MSA suffer from some disadvantages as compared to conventional micro-wave antennas. They are the following:

- Narrow BW;
- Lower gain;
- Low power-handling capability.

MSA has narrow BW, typically 1–5%, which is the major limiting factor for the widespread application of this antenna. Increasing the BW of MSA has been the major thrust of research in this field, and broad BW up to 70% has been achieved

V. CONCLUSION AND FUTURE SCOPE

A theoretical survey on microstrip patch antenna is presented in this paper. After study of various research papers it concluded that Lower gain and low power handling capacity can be overcome through an array configuration and slotted patch. Some characteristics of feeding technique and various antenna parameters are discussed. Particular microstrip patch antenna can be designed for each application and different merits are compared with conventional microwave antenna.

Also shows the different antenna of UWB range with different shapes. I conclude them in this survey paper. In future continue this work with design a new rectangular ring shaped microstrip patch antenna. Also improve the gain, bandwidth and other properties.

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