

## Survey on Microstrip Antenna

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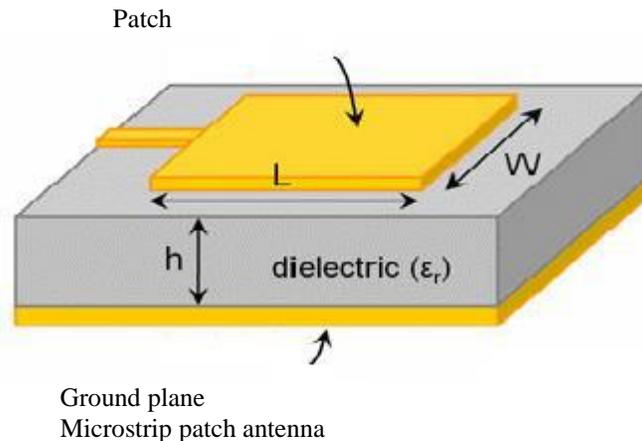
### ABSTRACT

Microstrip patch antenna have more advantages and better prospects if we compare them with conventional antennas. They provide dual and circular polarization, dual frequency operation, frequency agility, broad bandwidth, feed line flexibility, beam scanning omnidirectional patterning and are lighter in weight, low volume, low cost, low profile, smaller in dimension and are easy to fabricate. Microstrip patch antenna is very demanding and topic of interest for the researchers because of its several advantages over conventional antenna like low cost, light weight, easy to feed and their attractive radiation characteristics.

**Keywords--** microstrip patch antenna, frequency, radiation pattern.

### I. INTRODUCTION

Antenna is a transducer that converts one form of energy to another and transmits or receives the electromagnetic waves. Microstrip antenna consists of radiating patch on one side of dielectric substrate and ground plane on another side. Microstrip antenna is printed directly onto a circuit board because of that they are very useful. Radiating patch is made of conducting material (copper or gold) with many different shapes like rectangular, circular, and elliptical and many more shapes. The rectangular patch antenna is one half wavelengths long of rectangular microstrip transmission line.



### II. HISTORY

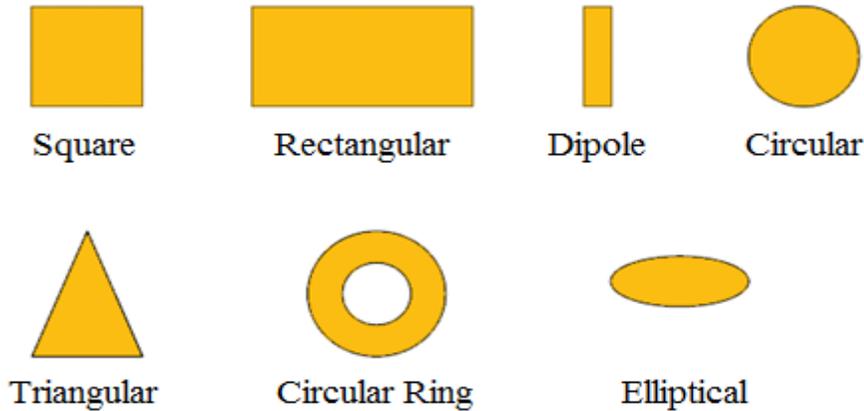
Microstrip patch antenna was introduced by Deschamps in 1950. However, this concept had to wait for about 20 years to be realized after the development of the printed circuit board (PCB) technology in the 1970s. Since then, microstrip antennas are the most common types of

antennas with wide range of applications due to their advantages of light weight, low profile, low cost, planar configuration, easy of conformal, superior portability, suitable for array with the ease of fabrication and integration with microwave monolithic integrate circuits (MMICs). They have been widely engaged for the civilian and military applications such as radiofrequency

identification (RFID), broadcast radio, mobile systems, global positioning system (GPS), television, multiple – input multiple-output (MIMO) systems, vehicle collision

avoidance system, satellite communications, surveillance systems, direct ion founding, radar systems, remote sensing, missile guidance, and so on.

**Microstrip patch antennas have number of physical parameters and have different geometrical shapes and size.**



**DIFFERENT SHAPES OF PATCH**

Categories of microstrip patch antenna:

- 1-Microstrip patch antenna
- 2-Microstrip dipoles

3-Printed slot antennas

4-Microstrip travelling wave antennas.

<b>Characteristic</b>	<b>microstrip patch antennas</b>	<b>microstrip slot antennas</b>	<b>printed dipole antennas</b>
1-profile	thin	thin	thin
2-fabrication	very easy	easy	easy
3-polarization	both linear and Circular	both linear and circular	linear
4-dual frequency Operation	possible	possible	possible
5-shape flexibly	any shape	mostly Rectangular and circular shape	rectangle and triangular
6-spurious radiation	exists	exists	exists
7-bandwidth	2-50%	5-30%	30%

### III. CHARACTERISTICS OF MICROSTRIP ANTENNAS

Every antenna has the characteristics specific for a type of application and not on others. An antenna can be characterized by:

1-Return loss  $S_{11}$

- The reflection loss corresponds to the reflection of the power supply input. A high return loss is therefore desirable as it results in a lower insertion loss.

- Input impedance is an important consideration to have of better result of antennas granted on transmitter or a receiver. By definition the input impedance of an antenna is the impedance view from the feed line. It is given by formula

$$Z_{in} = Z_0 \frac{1+S_{11}}{1-S_{11}}$$

2-Gain: The antenna badly radiate on a low gain. The gain allows measuring how an antenna radiates compared with reference antenna as a dipole. The gain is the result of two effects: the directivity (D) and return loss( $\eta$ )

$$G(\theta, \phi) = \eta * D(\theta, \phi)$$

3- Radiation pattern: The radiation or antenna pattern describes the relative strength of the radiated field in

various directions from the antenna at a fixed or constant distance.

### IV. IMPORTANCE OF PATCH IN ANTENNA

We should have patch in antenna because-

1-These antennas are lightweight, small in size and low profile.

2-Both liner and circular polarizations can be obtained using them.

3-Can be made compact.

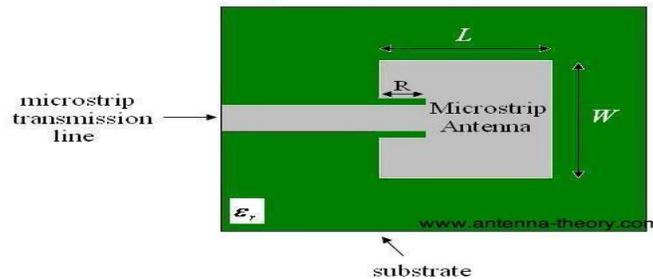
4-Ease of mass production using the printed circuits makes them a cheaper option to use.

5-Major advantage is that they can work in multiband of frequencies

### V. TYPES OF FEEDS

#### A-Direct Feeding

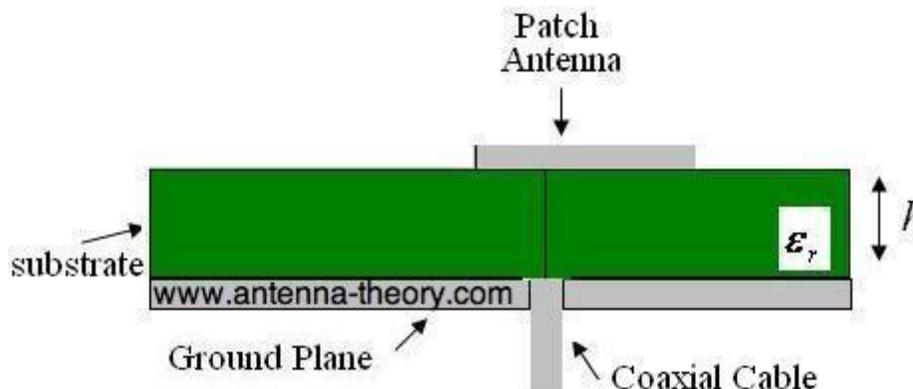
1-Microstrip Line Feed- This is the most basic and easy method used in the feed for microstrip patch antennas. The antenna is provided with excitation using the microstrip line



substrate

probe is connected to the ground plane in order to complete the circuit. The input signal is provided using the coaxial coupler

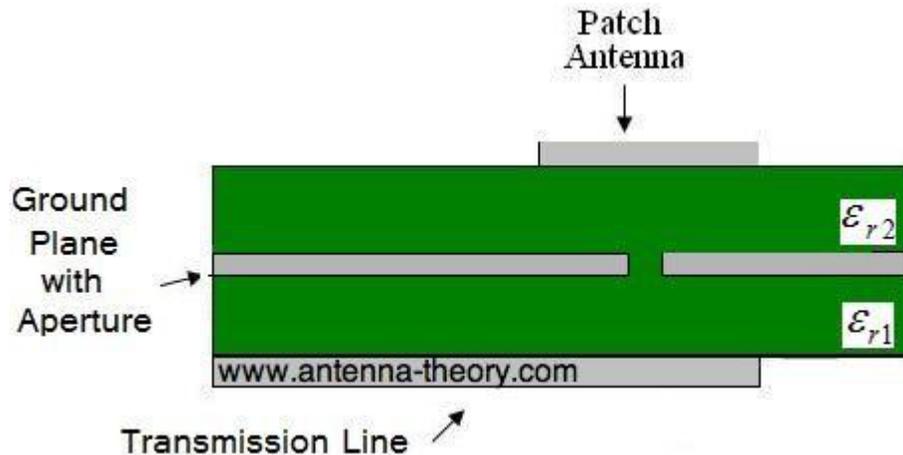
2-Coaxial Feed-The coaxial feeding method in which the central conductor directly touches the patch and thus provides the excitation to the patch. The outer part of the



### B-Indirect Feeding

These types of feeding are used when there is no actual contact between the patch and the input radiating material. These methods include Aperture Coupled Feed and Proximity coupled Feed.

1-Aperture Coupled Feed-The Figure below shows the aperture coupled feeding in which there is a small aperture or a slot cut into the ground plane in order to provide patch with radiation using the transmission line



## VI. ADVANTAGES AND DISADVANTAGES:-

Micro strip patch antenna has several advantages like they are lighter in weight, low volume, low cost, low profile, smaller in dimension and ease of fabrication and conformity.

The various advantages are given:

- 1-Low weight
- 2-Low profile and thin profile
- 3- Required no cavity backing
- 4-Linear and circular polarization
- 5- Capable of dual and triple frequency operation
- 6-Feed lines and matching network can be fabricated

The various disadvantages are given:

- 1-Low gain
- 2-Low efficiency
- 3-Larger ohmic losses
- 4- Complex feeding structure
- 5- Purity of polarization is difficult
- 6- Power handling capability is poor

## VII. APPLICATIONS

**1-Mobile and satellite communication application:** Mobile communication requires small, low-cost, low profile antennas. Micro strip patch antenna meets all requirements. In satellite communication, polarized radiation patterns are required and realized using square or circular patch.

**2- Radio frequency identification (RFID):** RFID is used in different areas like mobile Communication, logistics,

manufacturing, transportation and health care. This system uses frequencies between 30 Hz and 5.8 GHz. RFID systems is a transponder and a transceiver.

**3-Global positioning system applications:** Micro strip patch antennas have high substrate material for global positioning system (GPS).These antennas are circularly polarized.

**4- Medicinal applications of patch:** In the treatment of tumors the microwave energy is most effective way of inducing hyperthermia. The design of the radiator used for this purpose is light weight, easy handling and rugged. The initial designs for the Micro strip radiator based on the printed dipoles and annular rings which were designed on S-band and on the circular micro strip disk at L-band. If two coupled Micro strip lines are separated with a flexible separation which is used to measure the temperature of human body.

**5-Radar Application:** Radar can be used for detecting moving targets. It operates on low profile, light weight antenna, the microstrip antennas are an ideal choice for this.

## VIII. SIMULATION SOFTWARES FOR MICROSTRIP ANTENNAS

**HFSS software:-** HFSS is the tool for 3D full-wave electromagnetic field simulation. HFSS provides E- and H-fields, currents, S-parameters and near and far radiated field results

**IE3D:-** IE3D is software useful for circuit and antenna design. IE3D has a menu driven graphic interface with automatic meshing, and uses a field solver based on a full-

wave, method-of-moments to solve current distribution on 3D and multilayer structures of general shape.

**CST microwave studio:-** CST microwave studio (CST MWS) is a tool for the 3D EM simulation of high frequency components. CST MWS enables the fast and accurate analysis of high frequency (HF) devices such as antennas, filters, couplers, planar and multi-layer structures and SI and EMC effects.

## IX. CONCLUSION

This paper is a survey on the advancement of microstrip antenna over past years. It shows the types of microstrip antenna, feeding technique, applications etc. It also includes the software's used to design microstrip antenna. Microstrip antenna can be designed for many applications we have to select the correct feeding method for that application, software for designing etc.

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