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# Study of Different Types of Microwave Antenna and Its Applications

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**Abstract: This paper represents the classification of microwave antenna and its applications. Microwave antenna is a type of antenna which is operated at microwave frequency and they are widely used in many practical applications .A microwave antenna is a major system component that allows a microwave system to transmit and receive data between microwave sites. A microwave antenna is located at the top of a tower at each microwave site. Microwaves are radio waves with wavelengths ranging from as long as one meter to as short as one millimeter. Microwave antennas are widely used in various applications such as Televisions, and telephone communications are transmitted between ground stations and to and from satellites.**

***Keywords:*** **Antenna, Microwave antenna, types of antenna.**

## I. INTRODUCTION

In the world of communication basic need is an antenna. These paper deals with detail information of antenna which are operated in the frequency range of GHZ. Antenna is an important part of any wireless communication system as it converts the electronic signals into Electromagnetic.

***A Antenna Definition***

- The IEEE Standard Definitions of Terms (IEEE Std 145-1983)
- "An antenna is any device that converts electronic Signals to electromagnetic waves (and vice versa)" Effectively with minimum loss of signals [1].

***B.radiation pattern***

The radiation pattern is the representation of radiation properties antenna as a function of space coordinate.

***C. Polarization***

Polarization of EM fields describes the time variations of the time harmonic field vectors at a given points. In other words, it describes the way the direction and magnitude of the field vectors change in time. Polarization is a time harmonic field characterizes [2].

***D Effective aperture***

The Effective Antenna aperture is the ratio of the available power at the terminal of the antenna to the power flux density of a plane wave incident upon the antenna which polarization matched of the antenna.

***E directive gain of antenna***

The gain is also called as directive gain when the antenna radiates power in a particular direction relative to the average power radiated by the Antenna. An antenna has large aperture has more gain.

***F Directivity***

Directivity of an antenna is the ratio of the radiation intensity in a particular direction and the radiation intensity averaged over all directions.

***G antenna Beam width***

It is the angle, measured in a horizontal plane, between the directions at which the intensity of an electromagnetic beam.Large gain of antenna means smaller beam width.

***H Antenna side lobes.***

Antenna is not able to radiate all energy in single perfect direction. Some of the energy can be radiated in other direction, often there are small peaks in the radiated energy in different directions. This peak is referred as side lobes.

## II. CLASSIFICATION OF ANTENNA

Antenna can be classified on the basis of
1 Frequency
2 Apertures
3. Polarization
4. Radiation
This paper represents the classification of antenna according to frequency [3].

**A. *Classification of antenna based on frequency***

1. VLF antenna
2. LF antenna
3. HF antenna
4. VHF antenna
5. Microwave antenna

2.2 Microwave antenna

An antenna which is operated at microwave frequencies is known as microwave antenna. There are various types of Microwave antenna. And they are used in various applications.

**1 Classification of microwave antenna**

1 Micro strip Patch Antennas
2 Horn antennas
3 Parabolic antenna
4 Plasma antennas
5 MIMO antennas

**1 Micro strip Patch Antennas**

The concept of micro strip antennas was first proposed by Decamps in 1953. Howell and Munson developed the first practical antennas in the early 1970's. Since then, extensive research and development of micro strip antennas and arrays, exploiting their advantages such as low weight, low volume, low cost, conformal configuration, compatibility with integrated circuits, and so have led to many diversified applications. The basic configuration of a micro strip antenna is a metallic patch printed on a thin, grounded dielectric substrate.

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Originally, the element was fed with either a coaxial line through the bottom of the substrate, of by a coplanar microstrip line. This latter type of excitation allows feed networks and other circuitry to be fabricated on the same substrate as the antenna element, as in the corporate- fed microstrip array. The microstrip antenna radiates a relatively broad beam broadside to the plane of the substrate. [4]

***B Structure of micro strip patch antennas***

Microstrip antennas are attractive due to their light weight, conformability and low cost. These antennas can be integrated with printed strip-line feed networks and active devices. This is a relatively new area of antenna engineering. The radiation properties of micro strip structures have been known since the mid 1950's.The application of this type of antennas started in early 1970's when conformal antennas were required for missiles. Rectangular and circular micro strip resonant patches have been used extensively in a variety of array configurations. A major contributing factor for recent advances of microstrip antennas is the current revolution in electronic circuit miniaturization brought about by developments in large scale integration. As conventional antennas is often bulky and costly part of an electronic system, micro strip antennas based on photolithographic technology. In its most fundamental form, a Microstrip Patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side as shown in Fig.1. The patch is generally made of conducting material such as copper or gold and can take any possible shape. The radiating patch and the feed lines are usually photo etched on the dielectric substrate.

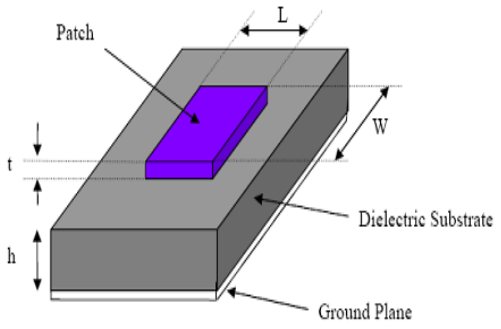


**Fig.1. Structure of Microstrip Patch antenna**

*a) Applications*

1) Global Positioning Satellite

2) Paging

3) Cellular Phone

4) Personal Communication System.

*2 Horn antennas*

The horn antenna is a natural evolution of the idea that any antenna represents a region of transition between guided and propagating waves. Horn antennas are highly suitable for frequencies where waveguides are the standard feed method, as they consist essentially of a waveguide whose end walls are flared outwards to form a megaphone-like structure. In the case illustrated, the aperture is maintained as a rectangle, but circular and elliptical versions are also possible. The dimensions of the aperture are chosen to select an appropriate resonant mode, giving rise to a controlled field distribution over the aperture. The best patterns (narrow main lobe, low side lobes) are produced by making the length of the horn large compared to the aperture width, but this must be chosen as a compromise with the overall volume occupied. A common application of horn antennas is as the feed element for parabolic dish antennas in satellite systems. [1]

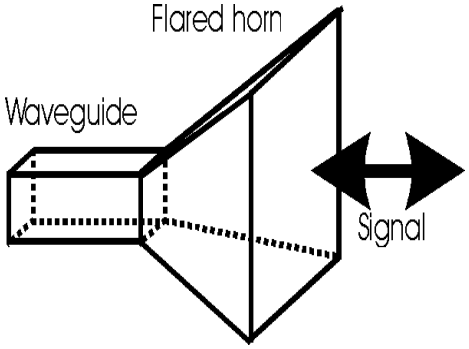


**Fig.2. A Schematic of the Experimental Setup of Plasma**

***Applications***

Horn antennas are extensively used at microwave frequencies when the power gain needed is moderate. For high power gains other antennas like lines or parabolic reflectors etc are preferred rather than horn antennas.

## III. PARABOLIC ANTENNA

A parabolic antenna is an antenna that uses a parabolic reflector, a curved surface with the cross-sectional shape of a parabola, to direct the radio waves. The most common form is shaped like a dish and is popularly called a dish antenna or parabolic dish. The main advantage of a parabolic antenna is that it has high directivity. It functions similarly to a searchlight or flashlight reflector to direct the radio waves in a narrow beam, or receive radio waves from one particular direction only. Parabolic antennas have some of the highest gains, that are they can produce the narrowest beam widths, of any antenna type. In order to achieve narrow beam widths, the parabolic reflector must be much larger than the wavelength of the radio waves used, so parabolic antennas are used in the high frequency part of the radio spectrum, at UHF and microwave frequencies, at which the wavelengths are small enough that conveniently-sized reflectors can be used. [4]

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**Fig.3.Satellite Dish Antenna**

***Applications***

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***Applications***

1) Point-to-point communications
2) In applications such as microwave relay links that carry telephone and television signals between nearby cities, WAN/LAN links for data communications, satellite communications and spacecraft communication antennas.
3) They are also used in radio telescopes

## IV. PLASMA ANTENNA

A plasma antenna is a column of ionized gas in which the free electrons emit, Absorb and reflect radio signals just as the free electrons in a metal antenna. The plasma antenna can be made to appear and disappear in milliseconds. The plasma antenna has an adjustable high-frequency cut off. It can transmit and receive low frequency signals while not interacting with high frequency signals. The plasma antenna can under special circumstances be made operational in the plasma antenna under special circumstances has less thermal noise than a metal antenna [6].

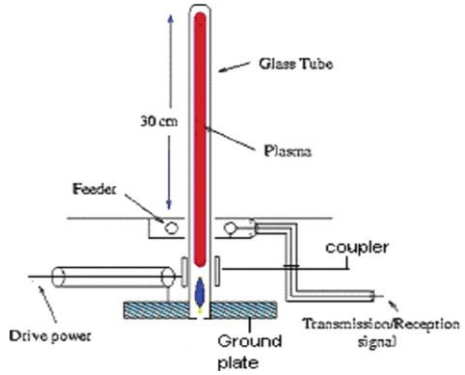


**Fig. 4. A Schematic of the Experimental Setup of Plasma**

**Applications**

1 High speed digital communication
2 Radar systems
3 In radio antenna
4 4G
5 RFID
6 Digital Home

***MIMO***

In radio, multiple-input and multiple-output, or MIMO is the use of multiple antennas at both the transmitter and receiver to improve communication performance. It is one of several forms of smart antenna technology. Note that the terms *input* and *output* refer to the radio channel carrying the signal, not to the devices having antennas .MIMO technology has attracted attention in wireless communications, because it offers significant increases in data throughput and link range without additional bandwidth or increased transmit power. It achieves this goal by spreading the same total transmit power over the antennas to achieve an array gain that improves the spectral efficiency or to achieve a diversity gain that improves the link reliability. Because of these properties, MIMO is an important part of modern wireless communication standards. The multiple antennas in MIMO systems can be exploited in two different ways. One is the creation of a highly effective antenna diversity system; the other is the use of the multiple antennas for the transmission of several parallel data streams to increase the capacity of the system [7].

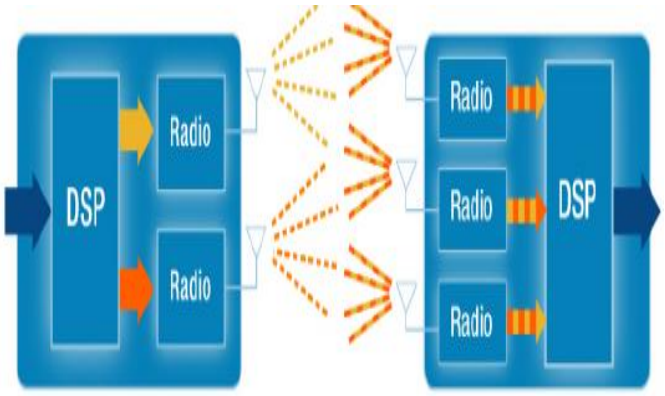


**Fig. 5. Working of MIMO antenna**

## V. APPLICATIONS

1 WLAN – WiFi 802.11n
2 Mesh Networks
3WMAN – WiMAX 802.16e
5 RFID

## VI. CONCLUSION

From the above elaborate study we conclude that a Microwave antenna is an essential part of wireless communication. This paper gives detail information about types of antenna and applications. And also contains the basics of antenna. The antennas which are mentioned in this paper they are being used in Radar, satellite, Radio, communication.

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