

Microstrip Antenna for Wireless Communication-A review

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Abstract

Antenna becomes prominent in wireless communication. Antennas attracted due to some special characterized with respect to the space filling, and even in self-similarity properties. Such kind of properties may lead to size reduction. In recent days designing of antenna relatively simple and easy because simulation tools are available. The antenna can be categories into many based on structure, frequency and mode application. Microstrip antenna attracted the research attention because of its simplicity and the various application used and it becomes popular. The microstrip antenna performance can be used multiple inputs and multiple output (MIMO). Day to day due the MIMO it has covered wide variety of application. Designer and researcher are working on deploy wideband antenna to increase the features of Multiple Input Multiple Output. In this paper communication system, classification of antenna and Microstrip antenna and some of the feeding techniques of microstrip antenna feeding, coupling and the applications advantages and disadvantages micro strip antenna is given overview

Keywords: *Microstrip, MIMO, wireless communication, Feeding techniques,.*

INTRODUCTION

Antenna is manufactured using electronic device that's what antenna is electronic

device. This device receives the signal from the one antenna and transmits at the other antenna nothing but the antenna

sends signal and receive electromagnetic signal. Day to day the communication had become major role in the human life and it becomes an integral part. As the population is increasing the demands are also increased but resources are limited this has attracted the scientist or the researcher spark in their mind the communication tool can change the life of people but to change the life style of people it is not so easy, because there are many challenges, how to communicate two entity ,for communication needed the radio nothing but frequency .The antenna can have capacity receive signal and send signal the researcher had invented in the antenna technology the antenna technology has attracted the people due to its cost, size so many parameters .Wherever the wireless communication the antenna is used nothing but air is the media which is used to transmit the information. In Mobile phone GSM900, 1800, 3G, 4G, GPS etc there are using multiple bands for that multiple antennas required to receive the signal and to transmit the power multiple antenna.

India is major country where its population resembles the essence of communication, to provide Communication to remote place with reducing cost but there are no such

manufacturing unit that satisfy the needs of the Indian population so every year the India depends on importing the antenna. Purchasing antenna from different country it costs more money because very less manufacturers are there in India.

Designing and manufacturing of antenna relatively simple. The communication system consists the one side is the transmitter the components are the Modulating the signal this component can modulate the signal and carrier frequency plays the important role because it has to carry the information from one device to another device both are combined together and it forms the modulator the. The modulator modulates the signal from analog to digital and vice versa and then this signal is amplified. The amplified signals are then transmitted in the air media with the help of antenna

At the receiver side antenna will receive the signals and fed to RF amplifier then to Mixer then to IF Filter and amplifier and demodulate the signals then display device is used to display information or speakers are used .Here radio transmitter is important component because it is used to transmit the signal or to receive signals from satellite.

Antennas are classified as below.

The Antennas may be divided into various types depending upon-

- Based on the physical structure of the antenna.
- Based on the frequency ranges of operation.
- Based on the mode of applications .

Antennas according to the modes of applications-

- Point-to-point communications
- Broadcasting applications
- Radar communications
- Satellite communications

Antennas according to the frequency of operation

- Very Low Frequency (VLF)
- Low Frequency (LF)
- Super High Frequency (SHF)
- Microwave
Radio wave
- Medium Frequency (MF)
- High Frequency (HF)
- Very High Frequency (VHF)
- Ultra High Frequency (UHF)

Antennas according to the physical structure

- Lens antennas

- Microstrip antennas
Array antennas
- Wire antennas
- Aperture antennas
- Reflector antennas

Microstrip antennas are actually very popular present days, Microstrip antenna can replace/alter many other antennas. The best example is hand held device like mobile phone, Bluetooth,GPS device, satellite, even a small device that receive signals.

The antenna according to the physical structure as classified one among them is microstrip antenna. This type of antenna is common and more popular due to its various advantages. Microstrip antennas are becoming more useful because they can be printed directly onto a printed circuit board. Microstrip antennas are most commonly used the microwave frequency region because of their simplicity and manufacturing is also is easy .

A microstrip patch antenna (MPA) contains a conducting patch for any non - planar or it's going to be coplanar. One aspect of a substrate and a ground plane on another side. it's a written resonant antenna narrow-band for microwave wireless links requiring semi-hemispherical coverage.

The microstrip antenna popular because of easy to integration and fabrication. The microstrip antenna acquired the mobile market. Microstrip antennas are low value, low profile and are simply or easy to fabricated on small chip. (See *Figure:-1*)

Microstrip antenna such as a narrowband is wide-beam antenna are fabricated with the help of etching the antenna element pattern in the metal trace bonded by the substrate as insulating, In Printed Circuit Board (PCB), metal layer bonded to the opposite side of the substrate that will forms a ground plane. Microstrip antennas are classified as many shapes such as square, rectangular, circular and elliptical

and any continuous shape is possible in microstrip antenna. Some microstrip antennas they are not using a dielectric substrate. Apart from substrate it can be made of a metal patch mounted above a ground plane using dielectric spacers. The Completed structure is a wider bandwidth. This type of antenna has a very low profile. This Microstrip antenna rugged by mechanically, shaped into to the curving skin of a vehicle, they are also often mounted on the exterior of aircraft and spacecraft. They are also incorporated into mobile, radio communication devices so on. Microstrip antennas have many forms or shapes. The Microstrip antenna shapes overview is given in figure-2

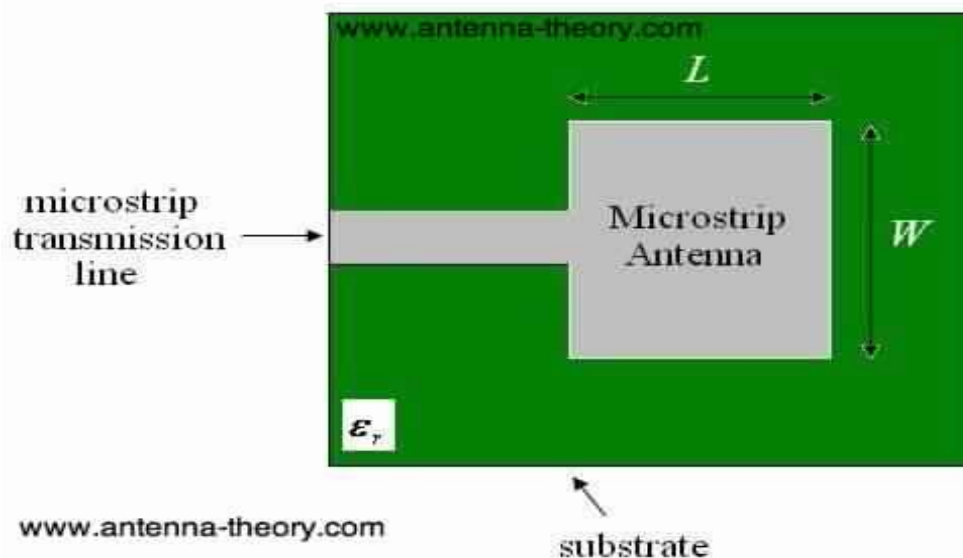


Figure-1 Microstrip antenna configuration

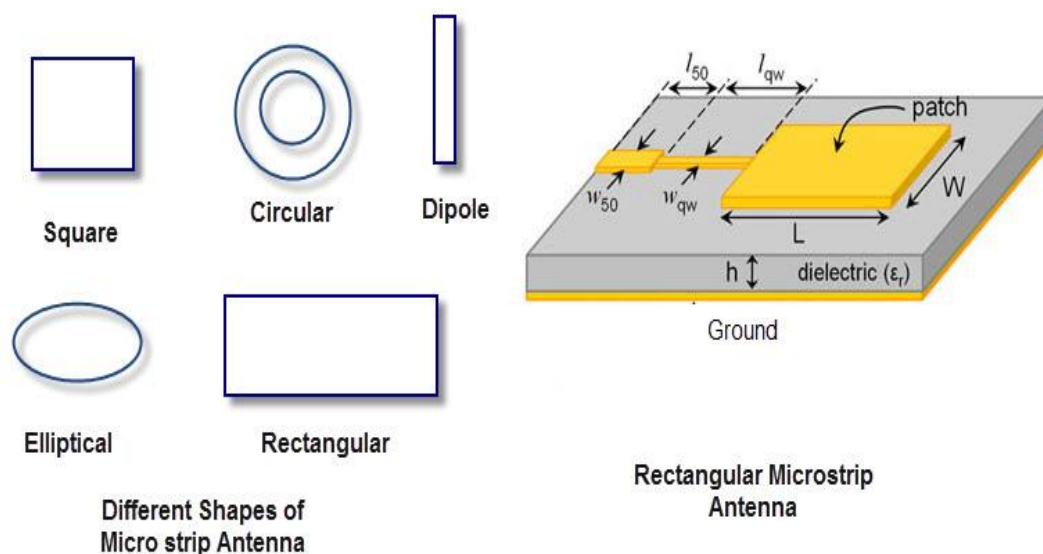


Figure-2 Representative shapes of microstrip patch elements.

Applications of Micro strip antenna can be various. One of them is Wideband Application: the wide band applications can be obtained by applying different iterations or rounds of fractal geometry antenna, from those wide band characteristics can be obtained .A fractal antenna helpful for super wideband and ultra-wideband applications.

another major application is Mobile Applications the mobile applications they make use of antenna for communication .Fractal antenna are essential as a single antenna the antenna can be designed to resonate for UMTS ,WLAN, ,GSM, Wi-Max, global positioning system applications. Therefore fractal antennas are practical suitable for mobile applications. Another important application of Microstrip antenna ie used in Multiservice

Integrated in Car this application uses small antenna are required in a car for radio reception not only these application as earlier mentioned mobile system can used for transmission in GSM, UMTS and for reception of signals ,In GPS navigation system, vehicle industry can use the fractal antenna.

RELATED WORK

Feeding in the microstrip patch antenna by various methods. The feeding technique can be categorized as contacting and non-contacting. In this paper author has express only few techniques ie four feeding method .There is no proper comparison is done. The popular feed techniques are presented i.e microstrip line, coaxial probe (both contacting schemes), aperture coupling and proximity coupling [1]

In this proposed scheme the design of a small and compact with a self-affine property of multiband fractal antenna is given. For the design of antenna the author has selected the substrate of dielectric constant $\epsilon_r = 4.4$ and thickness 1.6mm. Overall dimension of the proposed the compact antenna is characterized. Here the researchers used the probe fed fractal patch with two iteration. The antenna is designed and observation are made, that the antenna is radiating at multiple resonant frequencies. The resonant frequency is shifted from 2.32 GHz to 1.75 after first iteration and in second iteration the resonant frequency is shifted 1.26 GHz. In this design considerable size is reduced by around 48% and in the bandwidth 8.6% patch on one side of the dielectric substrate (with a ground plane on the other side. In the proposed method simulation tools are used to simulate the antenna and for result analysis the IE3D simulation tool is used [2].

In this Paper author is designed an microstrip antenna frequency of 2.4 GHz (ISM band), the rhombus shaped Microstrip antenna and fractal geometry is made. A fractal antenna has self similarity characteristics with these characteristics for multiband behavior. The fractal antenna resonates at 1.72 GHz with zeroth

iteration; for the first resonates at 1.37 GHz. size reduction of 68.96 % is achieved and the overall bandwidth is 380MHz is obtained. Simulation is done with the help of IE3D software [3].

Maíra Gonçalves Santos et al had designed for wireless application the Microstrip wideband antennas with different fractals geometries is designed. That paper presents three microstrip antennas models make use of different fractal geometries. Cantor's comb, Sierpinski carpet and Sierpinski triangle applying these radiators developed and combined with the feed systems that enable large bandwidths operation. [4]

This paper gives an idea of microstrip patch antenna Design using 5.2GHz resonant frequency. There are four different feeding techniques. Observed that all the designs are working in C-band with satisfactory bandwidth and radiation.[5]

Ravi Panwar et al This paper presents an overview idea of fractal frequency-selective surface embedded thin broadband microwave absorber coatings and these coating make use of heterogeneous composites that operate for a wide range of frequencies. The paper mainly focused on the fractal frequency selective surface

[FSS] with single, not only single it uses double-layer coatings. This kind of coatings are comprised of well-optimized micrometer-sized 80–90 m and nano-sized 20–30 nm [6]

FEEDING TECHNIQUES

In Microstrip antennas feed with various methods. The methods are categories into two groups contacting and non-contacting. (See Figure:-3)

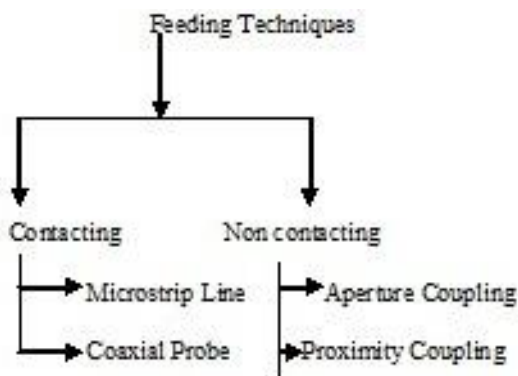


Figure-3 Shows the categories of feeding techniques

In contacting techniques the Radio Frequency power is fed by directly to the radiating patch with the help of connecting element such as a microstrip line. In a second method is an non contacting scheme, in this scheme the electromagnetic field coupling is done for the transfer of power between the microstrip line and the radiating patch. The categories of feeding techniques as shown fig-3.1.A feed line are used to radiate by

direct or indirect contact. Various techniques of feeding are microstrip line feed, coaxial probe, aperture coupling, and proximity coupling.

A. MICROSTRIP LINE FEEDING

Microstrip line feeding a conducting strip is connected on to the sting of the Microstrip patch. As compared to the patch the conducting strip is smaller in breadth. Microstrip printing operation is one among the better strategies to fabricate because it could be a simply conducting strip connecting to the patch and thus will be contemplated an extension of the patch. (See Figure:-4)

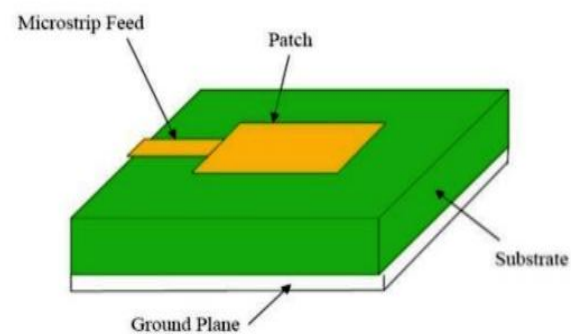


Figure-4 Microstrip line feeding

As shown in the figure-3.2 shows the overview of micro strip line feeding techniques. Microstrip line feeding has many advantages that the feed can be etched on the same substrate it can provide a planar structure. This structure is a simple planar structure and very popular.

Considering the liabilities with this method is that as substrate thickness will increase, not only increase the substrate thickness as well as surface wave and spurious feed radiation also increases which can restrict the bandwidth.

B. COAXIAL PROBE FEEDING

In microstrip feeding technique, The Coaxial probe feeding technique is so common technique. Considering the homocentric feeding methodology in which that the inner conductor and that is connected to the radiation patch of the antenna of the homocentric, the outer conductor is connected to the ground plane.

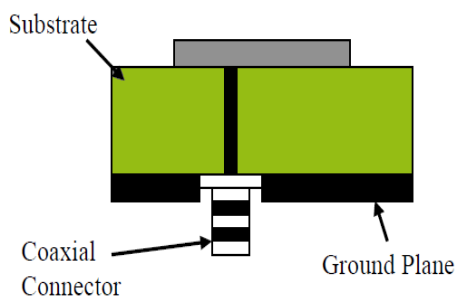


Figure-5 coaxial probe feeding

The coaxial line feeding techniques overall idea is shown in the figure-3.3 mainly here focused on some benefits coaxial probe feeding scheme. The coaxial feed that can be placed at any desired location inside the patch in order to match the input impedance; some of the benefits are listed.

- Easy of fabrication

- Easy to match
- Low spurious radiation

The liabilities of coaxial feeding is listed below

- Narrow bandwidth
- Especially it is Difficult to model for thick substrate.
produce cross-polarization radiation.

APERTURE COUPLING

In this kind of feed technique the aperture coupling is an indirect feeding method. The Aperture coupling micro strip antenna can be coupled through microstripline aperture.2 totally different substrates separated by a ground plane. On the very cheap aspect of lower substrate there's a microstrip feed line that energy is coupled to the patch through a slot on the bottom plane separating 2 substrates. Variations in the coupling will depend upon the size i.e. length and width of the aperture to optimize the result for wider bandwidths and better return losses. The coupling aperture is usually centered under the patch, leading to lower cross-polarization due to the symmetry of the configuration.

Normally prime substrate uses a thick low stuff constant substrate whereas for very cheap substrate; it's the high stuff substrate. The ground plane that is within

the middle isolates the feed from radiation component and minimizes interference of spurious radiation for pattern formation and polarization purity.

C. PROXIMITY COUPLING

In proximity coupling the fabrication is difficult process. Proximity coupling, largest bandwidth, less spurious radiation. Width-to-length ratio of patch is used to control the match and Length of feeding stub .

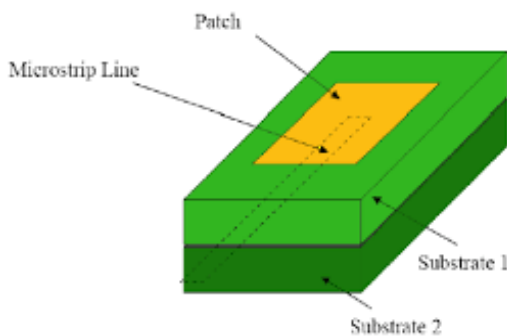


Figure-6 Proximity coupled Feed.

The proximity coupling it is referred as additionally, it is the magnetism coupling theme. The metal substrate used and the Two material substrate used, the feed line is specified between the 2 substrates, the diverging patch is on prime of the higher substrate. The figure-3.4 shows that the detailed overview of Proximity coupled Feed method. The benefits of proximity coupled feed eliminates spurious feed radiation and it is also gives drastically high information measure (as high as 13%) within the thickness of the microstrip patch antenna, overall increase because of this reason high information provides .Microstrip patch antenna reduce harmonic radiation and implemented in a multilayer substrate.

COPARISON OF FEEDING TECHNIQUES

Table.1 Comparison of feeding technique

Sl.No	Characteristics	Line Feed	Coaxial Feed	Aperture Coupled	Proximity Feed
1	Bandwidth	2-5%	2-5%	12-15%	8-10%
2	Fabrication	Easy	Soldering Required	Alignment Required	Alignment Required
3	Reliability	Better	Poor	Good	Good
4	Spurious Radiation	More	More	Less	Minimum

BENEFITS AND LIABILITIES OF MICROSTRIP ANTENNA:

BENEFITS

- Traditional antennas are not feasible to be designed but the Microstrip antenna they operate at microwave frequencies.
- Microstrip antenna has smaller size and hence will provide small size end devices.
- simple to print in any Printed Circuit Board is possible in the microstrip based antennas . Microstrip antenna are facilitate easy access for troubleshooting during design and development.Hence they're simple to fabricate micro strip pattern is visible and accessible from high.The microstrip patches of various shapes are easily etched. e.g. rectangular, square, triangular etc.
- The microstrip can be manufactured in a mass because of the lower cost for fabrication and simple to design.
- Microstrip antenna support dual polarization types are linear and circular both, Microstrip antenna are in light weight.

- Microstrip antenna can be mounted on rigid surfaces of the devices.

- Microstrip antenna is robust

LIABILITIES:

- Many microstrip based antennas the spurious radiation exists, microstrip patch antenna, microstrip slot antenna and printed dipole antenna.
- Due to dielectric losses and conductor losses.

Provides low efficiency it offers lower gain.

- Microstrip antenna higher level of cross polarization radiation.
- Micro strip antenna higher lower power handling capability.
- Microstrip antenna higher inherently lower impedance bandwidth.
- The microstrip antenna radiates from feeds and other junction points.

MIMO

In Multiple inputs multiple output (MIMO) system the mutual coupling is the major issue that degrades the performance of the MIMO system and arises due to

smaller space between the antennas. Different techniques to reduce Mutual coupling and those are including the increasing space between the antennas, MIMO technology plays vital role where in communication system. Nowadays MIMO techniques are used in different technologies such as WI-FI and LTE (long term evolution). The MIMO antenna are used in wireless communication like 2x2 MIMO, here the sender side two antenna and receiver side is two antenna like that 4x4 MIMO, 8x8 MIMO and many more MIMO antenna can be used in future. MIMO can increase the information turnout and reliability. This also helps to enhance the wireless system capability and frequency range. MIMO uses multiple antennas to transfer multiple parallel information signals from a transmitter. The signals will reach their destination on their own at the receiver receive the signals it urban areas, this multi path will bounce off trees, ceilings and other commercial buildings. Hence MIMO antenna have many benefits, researchers are focused towards to improve MIMO antenna, the massive MIMO antenna are used.

CONCLUSION AND FUTURE SCOPE

This paper reviews many research paper published by different researcher, some of the authors are focused on the feeding

techniques and some of the author had compared the methods and the MIMO in brief. A lot of work is carried out in microstrip for its better utilization if or the future generation of wireless communication. MIMO technology improves the throughput, bandwidth, bit rate, error rate of future wireless systems. To improve the gain and bandwidth of the Microstrip Antenna there are many methods are used. The paper presents the advantages and disadvantages of microstrip antenna and mainly there are Applications of microstrip antenna, the classification of microstrip antenna are taken into consideration and reviewed. The researchers are keen interest in microstrip antenna because of its easy to design and fabrication this paper helps the researcher to know about the brief facts about the microstrip antenna. This can lead the researcher get into depth of microstrip antenna design and for better performance.

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