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Survey of Microstrip Patch Antenna Enhancement Techniques

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Abstract: In this paper, we published a survey and analysis on a variety of the various strategies for maximizing gain and bandwidth. Because of their low profile, light weight, low cost, compactness etc., Microstrip Patch Antenna (MPA) is widely used in various antenna systems. Owing to its versatility, the patch antenna is often used with the Microwave IC and Monolithic Microwave IC's. But MPA's lower gain and bandwidth is one of the key disadvantages. The researchers used various methods to achieve enrichment, such as in the microstrip antenna array, superstrate structure, change of dielectric material and partial removal of substrates.

Keywords: Patch Antenna, Feeding Techniques, Shapes and Polarization

I. INTRODUCTION

Microstrip patch antennas are widely used in many wireless communication applications because of their various advantages such as light weight, compact size, low cost, simple manufacturing and high reliability[1]-[5]. The drawbacks of microstrip antennas are therefore limited bandwidth and low gain.

Microstrip antenna's radiation properties suffer from many design factors, such as feeding techniques, substrate manufacturing, patch, and ground structure.

This manuscript presents a review of the most popular methods of microstrip antenna gain and bandwidth enhancement, and reports a quick description of their feeding techniques. Performance parameters such as bandwidth and loss of reflection are assessed and then compared from single-layer dielectric substrates[6]-[10]. Results indicate major bandwidth increase using patch antenna configuration on a multilayered dielectric substratum. Microstrip antenna bandwidth is small, and varies directly with patch dimensions.

Increasing patch size to increase bandwidth makes it wide and hulking. A patch on multi-layer scheme was designed to scale back the efficient dielectric constant [11]-[6] in order to reach the bandwidth limit without unacceptably increasing the size This ensures that bandwidth increases greatly while size is almost unaffected.

II. MICROSTRIP PATCH ANTENNA

The patch design features a proposed size and provides a bandwidth and gain of the antenna designs tested on the microstrip. We all know that the Microstrip Patch Antenna is commonly used due to its low profile and more benefits, but at the same time it still has certain drawbacks such as lower bandwidth and lower latency..

A. They are lightweight and have a small volume and a low-profile planar configuration
B. Their ease of mass production using printed-circuit technology leads to a low fabrication cost
C. They are easier to integrate with other MICs on the same substrate
D. They allow both linear polarization and circular polarization
E. They can be made compact for use in personal mobile communication
F. They allow for dual- and triple-frequency operations

Despite these benefits, MSAs often suffer from some drawbacks compared to traditional microwave antennas.

1) Narrow bandwidth
2) Lower gain
3) Low power-handling capability

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MSA's have limited bandwidth, usually 1–5%, which is the main limiting factor for those antennas' widespread use. Throughout this area, raising the BW of MSAs was the main thrust of study.

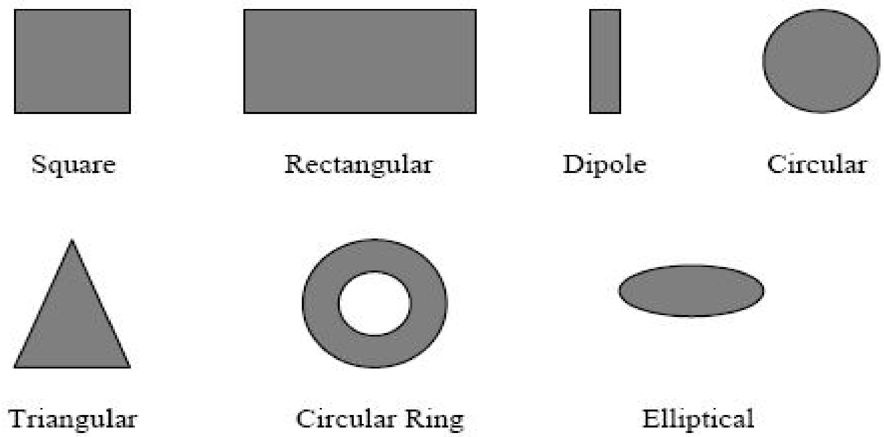

Fig.1. Various Shapes of Microstrip Patch Antenna

Antenna may be a transducer that converts one form into another and transmits or receives the electromagnetic waves. Micro strip antenna consists of radiating patch on one side of dielectric substrate and ground plane on the opposite side. Micro strip antennas printed directly onto a circuit card due to that they were very useful. Radiating patch is formed of conducting material (copper or gold) with many various shapes like rectangular, circular, and elliptical and lots of more shapes. Antenna can be a transducer that converts one form into another and transmits the electromagnetic waves or receives them. Micro strip antenna consists of radiating patch on one side of the dielectric substratum, and on the other side of the ground plane. Micro strip antennas were printed directly onto a circuit card because they were extremely useful. Radiating patch consists of conductive material (copper or gold) with many different types such as rectangular, circular, and elliptical and many other types. The oblong patch antenna is a rectangular micro strip wire, one-half wavelength long. The Patch antenna is a small band and antenna with wide-beams. Electromagnetic field coupling is done within the non-contacting scheme to pass power between the microstrip line and, thus, the radiating layer. Microstrip thread, coaxial probe (both contacting systems), aperture coupling, and proximity coupling (both non-contacting schemes) are the four hottest feed techniques employed. The methods are as follows.

a) Microstrip line feed
b) Coaxial Feed
c) Aperture Coupled Feed
d) Proximity Coupled Feed
e) Coplanar Waveguide Feed
f) Low fabrication cost, hence can be manufactured in large quantities. Supports both, linear as well as circular polarization.
g) Can be easily integrated with microwave integrated circuits (MICs).
h) Capable of dual and triple frequency operations.
i) Mechanically robust when mounted on rigid surfaces.

Microstrip patch antennas have a really high antenna quality factor (Q). It represents the losses related to the antenna where an outsized Q results in narrow bandwidth and low efficiency. Q is often reduced by increasing the thickness of the dielectric substrate. But because the thickness increases, an increasing fraction of the entire power delivered by the source goes into a surface wave. These surface wave contributions are often counted as an unwanted power loss since it's ultimately scattered at the dielectric bends and causes degradation of the antenna characteristics. Other problems like lower gain and lower power handling capacity are often overcome by using an array configuration for the element. After the right selection of the substrate material a computer aided design of the geometry is initially made and a negative mask of the geometry to be generated is printed on a transparent sheet. One or double sided substrate with copper metallization of suitable dimension is correctly cleaned using acetone to free from impurities. a skinny layer of negative photo resist solution (1:1 mixture of negative photo resist solution and thinner) is coated using spinning technique on copper surfaces and is dried.

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The mask is placed onto the resistant photo and exposed to UV light. When treated with developer solution, the layer of photo-resistant material inside the exposed portions hardens after the correct UV treatment. Using multiple elements as an array that is excited through a feeding network is the most popular technique for getting high antenna gain. However, antenna arrays usually require large size and thus the feeding network design is complex to get the specified phase response to rescale unstable radiation performance and loss of signal.

In general, one microstrip antenna element's radiation diagram is wide and provides little gain. For some uses, antennas with directive radiation are favoured for providing long distance communication. This will be done by the use of an array of radiating elements arranged in many geometric structures. The array's weather is usually just like delivering simpler, more convenient, and more practical design.

The array 's total radiated field is always determined by adding the radiated field to the vector through the individual elements, assuming the present in each element is like that of the isolated element , i.e. neglect coupling.

This typically depends on the separation between the environment to realize directive patterns, the fields of elements need to attach (constructively interfere) in the desired directions and cancel each other (destructively interfere) in other directions. The overall performance of the antenna array depends primarily on many factors which are the array configuration, such as linear, rectangular, circular, etc., the relative pattern of the radiating elements, the amplitude of excitation and the phase of the elements, and thus the spacing between the elements.

III. FEEDING TECHNIQUES

There are different methods available for feeding patch antennas on microstrip. Those methods are often methods of contact and non-contact. The RF power is fed on to the radiating patch using a connecting element like a microstrip line inside the contacting method. In the non-contacting process, power is transferred b by electromagnetic coupling between the microstrip line and hence the radiating layer.

There are several feeding techniques but the four hottest feeding techniques used are microstrip thread, coaxial probe (both contacting systems), aperture coupling, and proximity coupling (both non-contacting schemes

This type of feed arrangement has the advantage that the feed is always etched to provide a planar structure on an equal substratum. In this, the coaxial connector’s inner conductor extends across the dielectric and is soldered to the radiating patch while the outer conductor is attached to the underside surface.

The major advantage of are often "> this is often that the feed can be placed inside the patch at any of the 26 locations specified to match its input impedance. The downside is that it offers limited bandwidth and makes modelling complex. For this procedure, the bottom plane divides the radiating patch and, thus, the microstrip feed axis. The patch and thus the feed line are connected to the bottom plane by a patch. The coupling slot is centered the patch, resulting in low cross polarization thanks to the configuration symmetry. Since the bottom plane separates the patch and therefore the feed line it minimizes spurious radiation. The most downside of this feed technique is that it is difficult to produce thanks to multiple layers which also increase the thickness of the antenna. Additionally this kind of feed technique is named because of the electromagnetic coupling scheme. There are two dielectric substrates used and the feed line between the two substrates is therefore between. The radiating patch is placed above the upper substratum. This feed technique has the greatest advantage of eliminating spurious feed radiation and providing very high bandwidth (up to 13 per cent). The main disadvantage of this feed scheme is that due to the 2 dielectric layers which require proper alignment, it is difficult to manufacture.

IV. POLARIZATION

Polarization is that electromagnetic radiation property which describes the time-varying direction and relative magnitude of the electrical field vector as observed along the propagation direction. Antennas will be equally polarized to transmit and receive or there would be further losses. Three types-linear polarization, circular polarization, and elliptical polarization are on the theory of axial ratio polarization. The transmission and therefore the receiving should be similarly polarized otherwise more losses will occur. When we are using linear polarization then the transmitting and receiving antenna orientation should be right. This alignment limitation is often eliminated with the use of circular polarization. Polarization of the circulation (CP) is often achieved by making the axial ratio sufficient to one. Two forms of circular polarization-right CP (RHCP) and left CP (LHCP)-are used. When a circularly polarized wave strikes with a metallic object, its sense of polarization changes as a result of which the receiving antenna can distinguish between direct path waves and indirect path waves.

Table.1. Parameters of Microstrip Patch Antenna

Sl.No	Substrate	Feeding Techniques	Feeding Characteristics (Radiation, Fabrication, Impedance Matching)	Size Reduction	Bandwidth	Efficiency
1.	Bakelite	Microtrip Line Feed	More, Easy, Easy	Medium	Medium	88.65
2.	FR4	Coaxial Feed	More, Easy, Easy	Medium	Medium	99.60
3.	RO4003	Aperature Coupled	Less, Required, Easy	Medium	Medium	98.65
4.	RT Duroid	Proximity Coupled Feed	Minimum, Required, Easy	Medium	Medium	89.58

V. CONCLUSION

The goal of this review paper is to clarify the straightforward microstrip patch antenna and ways of improving its efficiency to enhance its applicability. The microstrip antenna's bandwidth is basically its principal restriction. Through this review paper we presented that circular polarization is often accomplished by changing the shape of the patch antenna or by using different feeding techniques, which helps to increase the bandwidth of the MSA. We have addressed different slotted MSA and it is clearly seen that slot shape and size often help to achieve improved bandwidth, better efficiency and gain. Cavity use reduces surface waves which enhance antenna efficiency

REFERENCES

[1] Indrasen Singh andDr. V.S. Tripathi, “Micro strip Patch Antenna and its Applications: a Survey”, Int. J. Comp. Tech. Appl., Vol 2 (5), 1595-1599.
[2] Sanchita Basu, Ashish Srivastavaand Abhishek Goswami, “Dual Frequency Hexagonal Microstrip Patch Antenna”, International Journal of Scientific and Research Publications, Volume 3, Issue 11, November 2013.
[3] Kiran Jainand Keshav Gupta, “Different Substrates Use in Microstrip Patch Antenna-A Survey”, International Journal of Science and Re-search (IJSR) ISSN (Online): 2319-7064 Impact Factor (2012): 3.358.
[4] Sunil Singh, Neelesh Agarwal, Navendu Nitinand Prof.A.K.Jaiswal, “Design consideration of Microstrip Patch Antenna”, International Journal of Electronics and Computer Science EngineeringISSN-2277-1956.
[5] Raju vermaand Namrata Dewangan, “Equilateral Triangular Micro strip Patch Antenna Using Different Substrates”, International Jour-nal of Advance Foundation and Research in Computer (IJAFRC) Volume 1, Issue 3, March 2014. ISSN 2348 –4853.
[6] K.S.Tamilselvan,S.Mahendrakumar,”Design Of Compact Multiband Microstrip Patch Antennas", Journal Of Global Research In Computer Science,Vol-3,No.11,NOV-2012.
[7] Huda A.Majid,Mohammad K.A.Rahim,”Frequency Reconfigurable Microstrip Patch-Slot Antenna With Directional Radiation Pattern", progress in Electromagnetic Research,Vol.144,319-328,2014.
[8] Rajeshwar Lal Dua,Himanushu Singh,Neha Gambhir,”2.45Ghz Microstrip Patch Antenna with Defected Ground Structure for Bluetooth”, International Journal of Soft Computing and Engineering ,Vol-1,Issue-6,January-2012.
[9] Dr.Thirmurugan.T,Sundar .k,eta.,”Circular Polarization wideband E-shaped Patch Antenna for Wireless Applications”,International Journal of Engineering and Technical Research,Vol-2,Issue-3,March-2014.
[10] B.Sai sandeep, S.Sreenath kashyap,”Design and Simulation of Microstrip Patch Array Antenna for Wireless Communications At 2.45Ghz”,International Joural of Scientific and Engineering Research,Vol-3,Issue-11,November-2012
[11] C.Vivek, S.Audithan „„Robust Analysis of the Rock Texture Image Based on the Boosting Classifier with Gabor Wavelet Features"", Journal of Theoretical and Applied Information Technology, 2014, 69, 562-570.
[12] S.Palanivel Rajan, K.Sheik Davood, “Performance Evaluation on Automatic Follicles Detection in the Ovary”, International Journal of Applied Engineering Research, ISSN No.: 0973-4562, Vol. 10, Issue 55, pp. 1-5, 2015.
[13] S.Palanivel Rajan, T.Dinesh, “Analysis of Human Brain Disorders for Effectual Hippocampus Surveillance”, International Journal of Modern Sciences and Engineering Technology, ISSN 2349-3755, Vol. No.: 2, Issue No.: 2, pages: 38-45, 2015.
[14] S.Palanivel Rajan, S.Vijayprasath, “Performance Analysis on Web based Traffic Control for DDoS Attacks”, International Journal of Engineering Research and General Sciences, ISSN: 2091 - 2730, Volume 3, Issue 1, 2015.
[15] S.Vijayprasath, S.Palanivel Rajan, “Performance Investigation of an Implicit Instrumentation Tool for Deadened Patients Using Common Eye Developments as a Paradigm”, International Journal of Applied Engineering Research, ISSN No.: 0973-4562, Vol. 10, Issue No.1, pp. 925-929, 2015.
[16] S.Palanivel Rajan, “A Survey on Detecting Methods of Driver Drowsiness”, International Journal of Innovations in Engineering and Management, ISSN: 2319-3344, Vol. 4, Issue No. 1, pp. 1-5, March 2015.