NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY
[IJIERT] ISSN: 2394-3696 Website: ijiert.org
VOLUME 8, ISSUE 8, Aug. -2021

BANDWIDTH ENHANCEMENT OF MICROSTRIP PATCH ANTENNA

Ms. Prajkta Amol Dange
Department of E&TC, DBATU University/
Ashokrao Mane Group of Institution, Wathar, India
Prajkta.dange18@gmail.com

ABSTRACT
Over the past one decade, there is a rapid growth in development of various applications involving wireless communication. The performance of all such wireless systems depends on the design and proper functioning of the antenna. Metamaterials are artificial metallic structures having simultaneously negative permittivity (ε) and permeability (μ), which leads to negative refractive index. No other material in the world shows the above properties like Metamaterial. Due to these unusual properties Metamaterial can change the electric and magnetic property of electromagnetic wave passing through it and because of these reasons when Metamaterial is used in the fabrication of antennas the required properties can be enhanced. Using this Metamaterial antenna the demerits of ordinary patch antenna like narrow bandwidth can be overcome. Bandwidth enhancement will achieved by maintaining return loss, impedance, VSWR these parameters

INTRODUCTION
In the age of communication everyone wants to be wireless. Antenna is device which is converts circuit energy into field energy. It makes system wireless. There are various types of antennas such as wired, non wired, wideband, narrowband, frequency independent, low, moderate and high gain antennas. The shape and size of antenna affects system design. From simple dipole antenna variety of antennas are available such as helical, dish, log periodic, yagi uda. These antennas have certain advantages. However size and geometric structure of these antennas are major drawbacks. Therefore microstrip patch antennas are becoming more popular over these antennas due to their features such as small size, conformability to the surface and ease of production, but narrow bandwidth is major drawback of microstrip patch antenna.
Rapid development of microwave technology, there is a growing demand on the bandwidth keeping this vision in mind bandwidth of microstrip patch antenna is enhance. The various techniques are use for bandwidth enhancement. In recent day metamaterial are gaining important due to their amazing properties. Bandwidth of patch antenna is enhancing using metamaterial and defected ground structure. The conventional and proposed enhance bandwidth antenna are designed at 2.45GHz using high frequency structure simulator (HFSS).

LITERATURE REVIEW
For design microstrip patch antenna refer IEEE Papers, research gate articles, IJAERD papers as following

1. **Design and Analysis of Split Ring Resonator Based Microtrip Patch Antenna for X Band Application**

Author: S.Roinson
[INTERNATIONAL JOURNAL, Volume 2, January 2019]
In this paper, a microstrip patch antenna for X band application is proposed and designed. FR4 Substrate is use. Slots are taken in this design in order to enhance the bandwidth. The Slots are used in the shape of split ring resonator**.**

2. **Microstrip patch antenna covered with Left Handed Metamaterial**

Author: M.karaaslan,E.Dogan, D.Kapusuz, C.Sabah.
[ACES JOURNAL, Volume. 28, October 2013]
This paper presents microstrip patch antennas covered with metamaterial substrate composed of split-ring resonators and metallic strip. This article describes a novel way to enhance both the gain and directionality of patch antenn used for WLAN applications. Split-ring resonators (SRRs) responsible for negative permeability and metal strip responsible for negative permittivity are used to improve both gain and

directionality of patch antenna. In this paper explained that microstrip patch antenna based on metamaterial exhibits improvement on the antenna gain performance

3. Analytical Review Of Bandwidth Enhancement Techniques OF Microstrip Patch Antenna
Author:Md Mohiuddin Soliman, Muhamad Mostafa Amir Faisal, Engr. Mohammad Lutful Hakim, Mahfuzur Rahman, Mohammad Masum Billah, Md. Nurnobi Chowdhury Sadam
[IEEE,March 2019]
The motive of this paper work is to demonstrate a survey on various bandwidth enhancement techniques bandwidth enhancement of MPA namely as slot technique, air gap technique, multiple radiating element technique,, parasitic patch technique,, multiple feeding technique, proximity couple technique and make comparative analysis between them.

4. Bandwidth Enhancement Of a Rechtangular Inset-Fed Microstrip Patch Antenna With DGS For ISM Band
Author: Vikram Reddy Anapana, Nimmagadda Priyanka ,Vajrap Prem Sai
[IEEE, 2019]
This paper presents the design of a micro-strip patch antenna with DGS for wireless LAN applications which can operate at 2.46GHz centre frequency with DGS (Defected Ground Structure) and 2.44GHz centre frequency without DGS which lies in the Type-B of ISM band.

5. Gain and Bandwidth Enhancement techniques in Microstrip Patch Antenna.
Author: Alok Kumar, Nancy Gupa, P.C.Gautam
[INTERNATIONAL JOURNAL OF COMPUTER APPLICATION, Volume 148, August 2016]
This paper represented various bandwidth enhancement techniques. The paper comprises of a brief study in feeding techniques, parasitic patch elements, introduction of slots, dual feed, shorting pin, air gap and recently introduced concept of defective ground structure that enhances the gain and bandwidth of antenna without increasing its height.

6. Performance Enhancement of Microstrip Patch Antenna using Metamaterial cover.
Author: Mr. Chaitanya Vijaykumar Mahamuni.
[IEEE 2016]
This paper represents a theoretical study of the use of metamaterial to improve the performance of path antennas. The output parameters of patch antenna without and with the metamaterial were obtained using MATLAB and their comparision is done to understand the effect of the metamaterial when it is used in a patch antenna

7. Gain and Bandwidth Enhancement of Mircrostrip Patch Antenna with Split Ring Resonator.
Author: Parvinder Kaur, Mandeep Kaur.
[IJARSET, Volume 4 ,February 2017]
This paper represents the improvement in gain and bandwidth of microstrip patch antenna, which is used with circular, rectangular and square shaped split ring resonator designed at a separate substrate

8. Introduction To Metamaterials.
Marek S. Wartak.
[IEEE 2011, Volume 67] :
In this paper**,** Meta materials are artificial structure designed to have property not available in nature. The electric permittivity and the magnetic permeability become simultaneously negative. The experimental works have conclusively demonstrated that optical losses can be fully overcome in negative refractive index

9. Comparative study of Microstrip Antenna for Different Substrate Material at Different Frequency.

Author: Mrs. Punita Mane, Dr. S.A.Patil, Mr.P.C.Dhanawade.

[IJEERT, Volume 2, December 2014]

This paper represent Limitations of microstrip antenna such as low gain, low efficiency and high return loss can overcome by selecting proper substrate materials. Permittivity of substrate is critical parameter in controlling band width, efficiency, and radiation pattern of patch antenna. In this paper, comprehensive study of effects of various dielectric materials on performance parameters of patch antenna is studied at different frequencies. Antennas are designed for different frequencies with two different substrate materials viz. FR4 and DURIOD. Finally the comparison is shown. HFSS (High Frequency Structure Simulator) is used for design simulation.

10. Microstrip Patch Antenna its applications.

Author: Indrasen singh, Dr. V.S.Tripathi.

[IJCTA, Volume 2, October 2011]

This paper describes the microstrip patch antenna,types ofmicrostrip antenna, feeding techniques and application ofmicrostrip patch antenna with their advantages and disadvantages over conventional microwave antennas.

CONCLUSION

This review paper shows techniques and methods for enhancing the bandwidth of MPA using metamaterial. Metamaterials is a new term describing a concept of artificial, man-made materials composed of small cells containing at least two different natural materials. Metamaterials can exhibit much more pronounce electromagnetic properties than natural materials so they can be used in the new high-speed broadband systems. However recent studies and experiment found that modification of shape of split ring resonator, by using array of resonators with thin wire. Also by stacking of patch antennas, by introducing split ring resonator at the ground plane.

REFERENCES

1) S.Roinson, “Design and Analysis of Split Ring Resonator Based Microtrip Patch Antenna for X Band Application”,INTERNATIONAL JOURNAL ON MICROELECTRONICS, Volume 2, January 2019.
2) M.karaaslan,E.Dogan, D.Kapusuz, C.Sabah, “ Microstrip patch antenna covered with Left Handed Metamaterial”,ACES Journal, Volume. 28, October 2013.
3) Md Mohiuddin Soliman, Muhamad Mostafa Amir Faisal, Engr. Mohammad Lutful Hakim, Mahfuzur Rahman, Mohammad Masum Billah, Md. Nurnobi Chowdhury Sadam,“Analytical Review Of Bandwidth Enhancement Techniques OF Microstrip Patch Antenna”, IEEE,March 2019
4) Vikram Reddy Anapana, Nimmagadda Priyanka ,Vajrap Prem Sai, “Bandwidth Enhancement Of a Rechtangular Inset-Fed Microstrip Patch Antenna With DGS For ISM Band”, IEEE, 2019.
5) Alok Kumar, Nancy Gupa, P.C.Gautam, “Gain and Bandwidth Enhancement techniques in Microstrip Patch Antenna”,INTERNATIONAL JOURNAL OF COMPUTER APPLICATION, Volume 148, August 2016.
6) Mr. Chaitanya Vijaykumar Mahamuni., “Performance Enhancement of Microstrip Patch Antenna using Metamaterial cover”,IEEE 2016.
7) Parvinder Kaur, Mandeep Kaur., “Gain and Bandwidth Enhancement of Mircrostrip Patch Antenna with Split Ring Resonator”,IJARSET Volume 4 February 2017.
8) Marek S. Wartak.,”Introduction To Metamaterials” IEEE 2011, Volume 67
9) Mrs.Punita Mane, Dr. S.A.Patil, Mr.P.C.Dhanawade., “Comparative study of Microstrip Antenna for Different Substrate Material at Different Frequency”, IJEERT, Volume 2, December 2014.
10) Indrasen singh, Dr. V.S.Tripathi, “.Microstrip Patch Antenna its applications”,IJCTA,Volume 2, October 2011.