IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 8, Issue 11, November 2020

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.488

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488 |

|| Volume 8, Issue 11, November 2020 ||

An Optimized Dual Band Highly Miniaturized Patch Antenna

Ankush Saraswat[1] , Gaurav Sharma[2]

Research Scholar, M.Tech, Mewar University, Chittorgarh, Rajasthan, India

Assistant Professor, Mewar University, Chittorgarh, Rajasthan, India

ABSTRACT: Wireless communication technology is the greatest discovery in advanced modern communication systems in human history. Information between one or more devices requires any physical media. This system efficiently transmits information in the form of radio waves on its antenna system. Modern technological systems like cellular satellites and missile applications have low demands due to their small size, light weight, performance and easy installation. Microstrip patch antenna is a thin antenna, which has many advantages over other antennas. They have the ability to integrate with microwave circuits, so they are very suitable for many applications such as cellular equipment, WLAN applications, navigation systems and so on. It is light and cheap, and electronic products like LNA can be easily integrated with these antennas.

I. INTRODUCTION

An antenna is a type of transducer that converts electrical energy into radio waves (electromagnetic energy) and vice versa. The antenna is used as an electromagnetic wave transmitter or an electromagnetic wave receiver. According to the IEEE standard, "antenna is considered as a means of transmitting and receiving radio waves" [1]. All wireless communication systems that need to be small or portable require antennas that are not bulky and take up less space.

In the public and commercial sector, the latest trend in communications systems is to develop a small, inexpensive, lightweight and compact antenna that can maintain high performance over a wide frequency range. This development has focused a lot of technical energy on the design of microstrip patch antennas. A patch antenna with a simple structure has many advantages over other antennas. For example, they are very light, simple, low profiles and cost effective when manufactured using printed circuit board technology and are compatible with flat and non-planar surfaces [2]. The design changes of the microstrip antenna may exceed any other type of antenna.

However, microstrip patch antennas also have many disadvantages. Some of their main disadvantages are low gain, narrow bandwidth and surface wave excitation with excitation radiation efficiency. To overcome the narrow bandwidth, various methods have been used [3]. A substrate with a low dielectric constant or a thick ferrite composition can provide a wider bandwidth, but the first method does not lead to a low profile design, and the second solution is expensive. The bandwidth of the antenna can be improved by a tight / aperture coupling method, but the manufacturing process is difficult for this technology. The bandwidth can also be improved using a stacked multi-resonator configuration, but it has a larger thickness prototype [4,5]. The electromagnetic band gap design has been used to reduce the surface wave of the antenna. To achieve a high-gain antenna, a number of patch elements are used [2].

II. DEVELOPMENT OF MICROSTRIP PATCH ANTENNA

The microstrip patch antenna (MPA) was first proposed by Deschamps [7] in 1953. Received a patent in France in 1955 under the name Baissinot and Gutton [8]. However, the first actual implementation was completed by Howell [9] and Munson [10] in the early 1970s. In the 1970s, its development accelerated due to the availability of good dielectric substrates. During this time frame, two MPA feeding methods were developed: edge feeding plastics and probe feeding plastics.

Research and development of MPA technology continued until the 1980s. The main contribution comes from the defense industry in the form of direct R&D or grants. Researchers have tried to increase the bandwidth of microstrip antennas. To overcome these limitations, two important methods of voltage for the antenna have been introduced: essentially capacitive aperture coupling supply and proximity coupling plasters. In the 1980s [11], some complex software tools and integrated equation techniques were established. These methods can calculate the antenna more accurately.

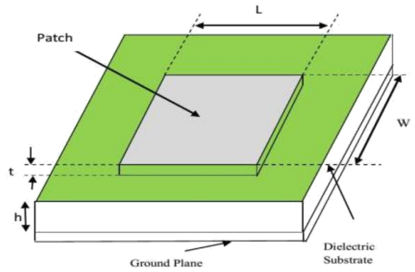

Fig.1- Basic structure of a microstrip patch antenna

ADVANTAGES OF MICROSTRIP PATCH ANTENNA

MPA has many advantages over conventional microwave antennas. The basic benefits are rarely mentioned below.

• They are light, compact and small.
• They can be kept in shape on the host's surface.
• The ease of mass production using printed circuit board technology reduces production costs.

OBJECTIVE

The purpose of this work is to design a dual band patch antenna with different services. By inserting slits or slits in the radiation or ground plane to design a reduced or compact microstrip antenna. Since patch antenna generally show low bandwidth, research has been conducted into the increase in bandwidth. The enhancement of microstrip antennas is also being investigated and some patch antenna with increased gains has been designed. This work also implements multi-frequency operation. Some designs have been developed with the combination of compactness, improved gain and multi-frequency operation. Finally, the use of dual patch antennas in the medical field is being investigated.

III. METHODOLOGY

The dual band patch antenna has a very high antenna quality factor (Q). Q represents the loss associated with the antenna, while a large Q leads to narrow bandwidth and low efficiency. Q can be reduced by increasing the thickness of the dielectric substrate. But as the thickness increases, more and more of the total power that the source delivers enters the surface wave. The contribution of this surface wave can be counted as useless power loss because it eventually propagates in the bend of the dielectric and causes the antenna properties to decrease. As discussed by Qian et al. however, surface waves can be minimized by means of photonic band gap structures. By using the array configuration for the element, other problems can be overcome, such as lower gain and lower power handling function.

IV. PROPOSED SYSTEM

In this work designed a highly miniaturized dual patch antenna. U-shaped grooves are designed on the ground to achieve maximum return loss. By using coaxial feed, the highest performance can be achieved for the designed antenna. A substrate with a dielectric constant of 4.4, which is FR4 material. Finally find the right of return, radiation pattern, VSWR and bandwidth. Simulation using HFSS.13 (High Frequency Structure Simulator)One of the potential uses of WiMAX is to cover the so-called "last mile" (or "last mile") area, which means offering high-speed Internet access to areas that cannot be covered by standard wired technology (such as DSL, cable or dedicated T1). One possibility is to use WiMAX as a backhaul between two local wireless networks (such as wireless local area networks using the WiFi standard). WiMAX will eventually allow two different hotspots to be linked to create a mesh network. This article introduces WLAN broadband antennas and worldwide interoperability for microwave access (WiMAX) applications covering 2.4 / 5.2 / 5.8 GHz WLAN operating frequency bands and 2.5 / 3.5 / 5.5 -GHz WiMAX frequency band. The proposed printed antenna is based on a 1.6 mm thick FR4 epoxy substrate with a size of 25 mm £ 38 mm. It has a rectangular open ring groove enclosed in a rectangular patch. And part of the ground plane will resonate at the other two frequencies. The dimensions of the patch, ground and two slots are optimized to achieve the required functional frequency range. This article proposes a new type of tri-band antenna suitable for WLAN / WiMAX applications. Using the split groove implanted in the rectangular patch and the local ground plane etched by the U-shaped groove, three resonant states with excellent impedance performance can be realized. The compact size, triple band frequency, excellent radiation pattern, good gain and simple structure make this antenna suitable for three different frequency bands 2.4 {2.5, 3 {4, 5.2 {5.9 GHz.}

➢ **Proposed design**

- Length and width of the substrate:**14mm*14mm**
- Substrate material: **FR4**

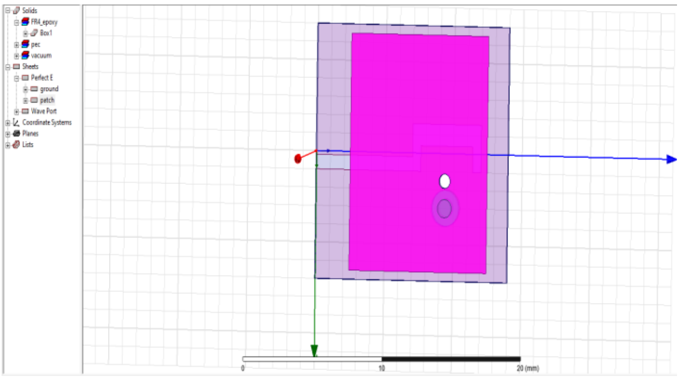

Fig.2 The patch antenna geometry (a) top view,

Fig. 2 shows the proposed patch antenna geometry and the detailed dimensions are listed in Table I. The proposed antenna is simply a patch antenna miniaturized using a shorting post close to the feeding position and a novel DGS. The dual-band property is achieved by etching a U-slot in the ground. As the current goes to the ground through the shorting post, this makes the ground part of the antenna. The patch antenna is fed with an SMA connector acting as a feeding probe at its edge. The antenna is fabricated on a double sided Rogers RO4350 substrate with dielectric constant of 3.48, loss tangent of 0.004 and thickness of 0.76 mm. The total antenna size along with its GND plane is 18.8mm by 20mm by 0.76mm which represents an ESA at 2.45 GHz even when the circle surrounds all the substrate. The radius a of the circle is 13.86 mm so that ka = 0.7 < 1.

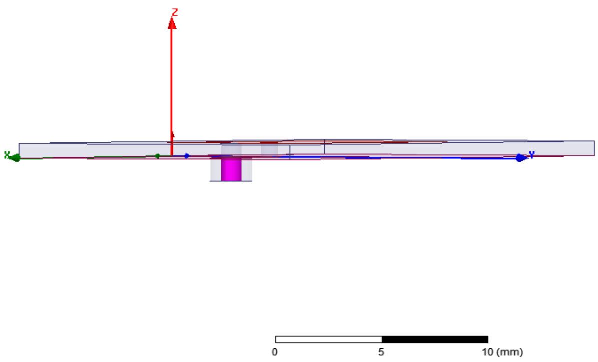

Fig. 3 The patch antenna geometry ,side view,

The proposed patch antenna was modeled, optimized and simulated using HFSSTM (version 15). Fig. 3 show the proposed patch antenna current distributions at 2.43 and 5.2 GHz, respectively. At 2.43 GHz, the highest current intensity traces two of the patch edges. Although the U-slot is etched on the ground, it affects the current on the patch. As the current go around the U-slot position in the ground, its electrical length increases thus explaining the miniaturization rule of the DGS. The current path length is found to be 32 mm which is approximately λ/4. At 5.2 GHz, the current is over two edges of the patch and in the ground is surrounding the DGS. The current path is approximately 23 mm which corresponds to about λ/2

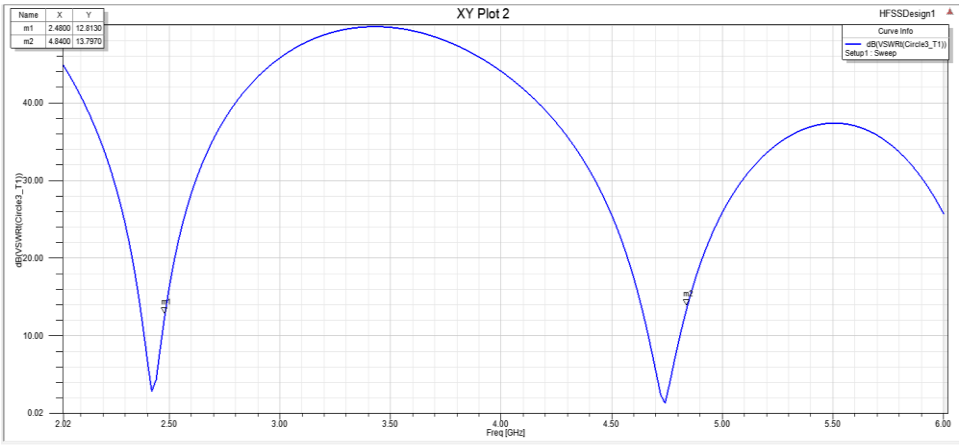

Fig4 radiation pattern

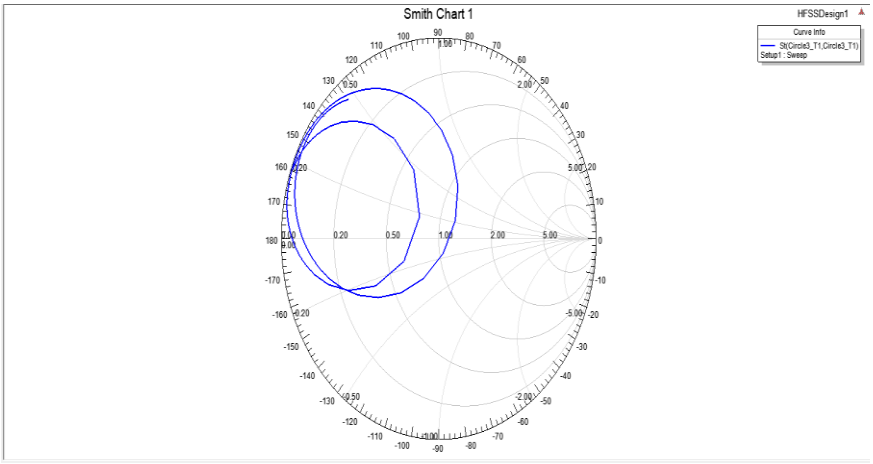

Fig 5 smith chart

V. CONCLUSIONS

It has been proven that the proposed antenna is a highly dual-band patch antenna, and the same antenna can be used in two dimensions. Due to the simple design of the design, the antenna is designed to be easier to design. Compared to other state-of-the-art antennas, the proposed antenna shows high antenna gain and high bandwidth. Finally, the antenna is designed to show better radiation patterns, better return losses and lower VSWR characteristics. Because two suitable dielectric requirements are required moreover, the thickness of the antenna increases. In research, there are always more aspects that can be investigated than what is presented. Here also, there are some aspects of both the new antenna and parameter calculation that can be extended. The new designed presented in this thesis open up the scopes for high gain, wide band and miniaturized microstrip patch antennas for wireless applications. The controlling tools like slot length, width, angle can be further exploited to achieve tunable parameters of micros trip patch antenna

REFERENCES

1. Jian Wang Wei-Bing Lu Zheng-Guo Liu A Hybrid Graphene-Metal IFA Antenna with Dynamically Tunable Operating Frequency at Microwave Freauencies 2018 IEEE International Conference on Computational Electromagnetics (ICCEM) Year: 2018 ISBN: 978-1-5386-1241-5 DOI: 10.1109/ IEEE Chengdu, China
2. Yu-Ze Jiang Lin-Sheng Wu Bin Xia Jun-Fa Mao Dual-Band Fabry-Perot Resonator Antenna Based on Hybrid Graphene-Metal Structure 2019 IEEE Asia-Pacific Microwave Conference (APMC) Year: 2019 ISBN: 978-1-7281- DOI: 10.1109/ IEEE : Singapore, Singapore, Singapore3517-5
3. Huang Yong Wang Wenjie Zhu Tianting Lai Jiankun Peng Dajuan Lyu Donglai Guo Yinquan Yuan Elfed Lewis Minghong Yang Graphene–Gold–Au@Ag NPs-PDMS Films Coated Fiber Optic for Refracti ve Index and Temperature Sensing IEEE Photonics Technology LettersYear: 2019 | ISSN: 1041-1135ve DOI: 10.1109/: IEEE

4. Junyi Ren Shuxi Gong Wen Jiang Low-RCS Monopolar Patch Antenna Based on a Dual-Ring Metamaterial Absorber IEEE Antennas and Wireless Propagation Letters Year: 2018DOI: 10.1109/ IEEE
5. Miroslav J. Veljovic Anja K. Skrivervik Patch Antenna System for CubeSats in L band 2019 13th European Conference on Antennas and Propagation (EuCAP) Year: 2019ISBN: 978-88-907018-8-7 IEEE Krakow, Poland, Poland
6. Sayeed Sajal Saeed I. Latif Edmund Spencer Circularly Polarized Small-Footprint Hybrid Ring-Patch Stacked Antenna for Pico-Satellites 2018 IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting Year: 2018 ISBN: 978-1-5386-7102-3 DOI: 10.1109/ IEEE Boston, MA, USA
7. M. Y. Mat Zain M. T. Ali A. N. H. Hussin B. Baharom 2.4GHz Patch Antenna on Bio-Composite Substrate Using Quarter Wave Transmission Line 2018 International Symposium on Antennas and Propagation (ISAP) Year: 2018 ISBN: 978-89-5708-304-8 IEEE Busan, Korea (South), Korea (South)
8. Neng-Wu Liu Lei Zhu Wai-Wa Choi Jin-Dong Zhang A Low-Profile Differentially Fed Microstrip Patch Antenna With Broad Impedance Bandwidth Under Triple-Mode Resonance IEEE Antennas and Wireless Propagation Letters Year: 2018 DOI: 10.1109/ IEEE
9. Hong-Wei Yu Yong-Chang Jiao Complementary Magneto-Electric Coupling Feeding Methods for Low-Profile High-Isolation Dual-Polarized Microstrip Patch Antenna 2019 International Symposium on Antennas and Propagation (ISAP) Year: 2019 ISBN: 978-7-9009-1404-0 Publisher: IEEE Xi'an, China, China

INNO SPACE

SJIF Scientific Journal Impact Factor

Impact Factor: 7.488

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details