A REVIEW OF OMNI- DIRECTIONAL PRINTED MONOPOLE ULTRA WIDE BAND DOBULE FED ANTENNA

Snehal Bharti[1]
M-Tech Scholar
Dehradun Institute of Technology, Dehradun, India,

Saurabh Mishra[2]
Assistant Professor (EECE)
Dehradun Institute of Technology, Dehradun, India,

Dr. Kuldeep Choudhary[3]
Assistant Professor (EECE)
Dehradun Institute of Technology, Dehradun, India .

Abstract— *The antenna design for high-speed multimedia communication expresses a challenging activity for engineers of fixed and mobile wireless systems. The expeditious increase of mobile systems approaching the fifth-generation (5G networks) requires multi-band, wideband, and UWB antennas suitable to satisfy mobile and wireless services and to decrease the system complexity, the overall device design dimensions, and costs*. *This paper proposed a compact two-channel multiple inputs multiple outputs (MIMO) printed micro strip antenna array with double fed printed monopole. The Omni-directional monopole antenna array is design with five elements and then two numbers of related arrays have been applied for MIMO application at 5.25 GHz. The antenna is formed of five rectangular-shaped patch elements that cascade of antenna elements organized alternately on the top and bottom covers of the substrate. The introduced two-channel printed monopole array is designed to give a solution for a WLAN base station antenna.*

Keywords- Omni-directional, Printed Monopole antenna, Double fed, Micro strip.

I. INTRODUCTION

With the development of modern communication, more bandwidth abilities of antenna systems are needed. At the same time, the antenna must perform the technical requirements for high execution, being lightweight and low profile, as well as the need to meet the new economic compulsions of low cost, simplicity, and reliability. Printed microstrip antennas already widely investigated and attractive for their conformtible, small size and cost-effectiveness. While their bandwidth capabilities have been pushed to upwards, this may still be not enough for some future system demands. A method that looks assuring for providing other attractive characteristics is the double-sided printed dipole. Printed dipoles keep the primary advantages of microstrip antennas, such as lightweight and good reproducibility. An additional benefit is an inherent capability of larger bandwidth in comparison with single-layer microstrip structures. Owing to its moderate cost, low profile, ease of fabrication and wide bandwidth, the printed planar structure performs to be the most assuring candidate for wideband applications. Recently, various planar antennas have been proposed and investigated because of their benefits [5– 7]. For example, a small UWB elliptical ring antenna fed by a coplanar waveguide has been submitted and studied in [9]. It achieved wideband performance by extending the length of the elliptical ring's major axis and showed an ultra-wide 10 dB return loss bandwidth from 4.6 to 10.3 GHz. Although the antenna has relatively compact dimensions of 29 × 26 mm, it does not cover the entire ultra-wideband. An improved design of a planar elliptical dipole antenna for UWB applications has also been developed recently [13]. By using elliptical slots on the dipole arms, the antenna has succeeded wideband characteristics, having an operating bandwidth of 94.4%. However, the antenna does not process a physically compact profile, having dimensions of 106 × 85 mm.

Objective

The main objective of project to studied the wireless communication antenna topologies. We trying to resolve the previous antenna design issues. We design an omni-directional radiation propertues based double fed printed monopole antenna haveing ultra band characteristics. We also studied the return loss along with copolar and cross polar radiation. It should be fabricated and design using low-cost circuit technology in antenna simulated CST Studio Suite Software.

II. LITERATURE SURVEY

It is well known, that the impedance bandwidth of the early micro-strip patch antenna is very narrow. A variety of researches has been done over the past years to defeat the significant gap. While many techniques have been proposed for bandwidth improvement, which involves the utilization of thick substrate with lower permittivity, stacked patch and predacious patch as well as etches slot on the patch and so on[1]-[3]. In the present day, the impedance bandwidth of a patch antenna can also be widened by using different feeding structures such as L-probe and aperture coupling technologies[6]-[8]. The former is a vertical feeding structure and the later is side feeding structure. The enhancement of bandwidth makes patch antenna has been widely used in a different moment, which not only serves for antenna solo but also is used radiation unit in the array. For passive array antenna, side feeding structure is becoming for most cases. Now, the active array has been widely used in phased array radar, smart antenna as well as new communication methods with multiple channels. Because every T/R module connects with a radiation unit in an active array, thus side feeding structure is not convenient for using as it in the passive array. Therefore vertical feeding L probe becomes the right choice of feeding structure for active array antenna. But common conventional L-probe fed patch[9]-[10] has some shortcomings, such as 3D structure L-probe is not easy to build, single L-probe fed patch antenna has not well-formed E-plane pattern and its H-plane cross-polarization level is more powerful. The co-planar printed L-probe can make the probe be easily built[11]. By introducing a second probe, which is fed out of phase with the original probe, symmetrical of E-plane pattern and H-plane cross-polarization level can be improved effectively[12]

III. PROPOSED SYSTEM

The outcomes of the literature review conclude that double fed monopole antennas have better performance. Different types of feeding methods and the various shapes of the patch are used to enhance the performance. Simulation of an antenna can be carried out on non-real time environment only. The various software can be used to simulate the design of antenna-like CST Microwave studio, Ansoft HFSS (High-Frequency Structure Simulation). For real-time applications in order to implement the hardware, antennas are required. Hence the required antenna has also been fabricated in order to simulate the results.

DOUBLE FED MONOPOLE ANTENNA

A unique perspective of the double-sided printed dipole is the use of the balanced twin line feed network. Since the transmission line employs both sides of the same substrate that each arm of the printed dipole resides upon, the architecture utilizes all of the well-known benefits of the planar microstrip system [7]. The surface wave losses can beexceptionally low due to the fact that the substrate can be very thin.

The most unadulterated version of a monopole antenna, the quarter-wave monopole above a perfect ground plane, is unstable, has an omnidirectional coverage with excellent polarization characteristics and is accessible to meet. But it has inadequa1te bandwidth. Thus in the past, this fundamental version of monopole has gone through numerous transformations to make it more wideband while keeping its radiation properties intact. It has been proposed planar monopoles with different shapes such as rectangular, square, elliptical and circular.

OMNI-DIRECTIONAL RADIATION PATTERN

The configuration of the presented compact Omni-directional printed antenna is shown in Figure.1.

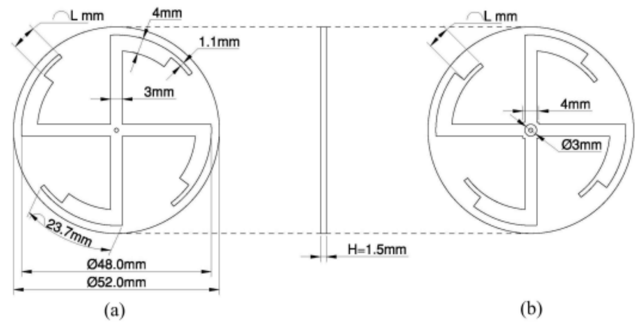

Figure 1. Geometrical structure presentation of the proposed antenna (a) top view (b) bottom view

The substrate is 26mm in radius and 1.5mm in thick with the dielectric constant 2.55. Using the loop current, the proposed antenna achieves horizontal polarization and Omni-directional pattern. According to the optimized results using the CST software, the two cross-shaped microstrip feed lines, which printed on the both sides of the substrate, are both 24mm in length and 3mm in width. A connector linked to the top and bottom strip is located at the center of the presented antenna. On the two sides of the substrate, there are four pairs of opposite ring arms, which are 4mm in width. Each pair of wings owns two interlaced branches, the curved branches have fixed 1.1mm width and use the variable L as its' length; all the parameters are marked in the figures. The proposed antenna is supposed to reduce the

co-channel interference caused by cross-polarization from thevertically-polarized interfering wave emitted from the base station of the other carriers.

COMPARATIVE STUDY OF MICROSTRIP PATCH ANTENNA WITH DIFFERENT SHAPES AND ITS APPLICATION

Standard antennas, such as lighter weight, lower volume, less cost, low profile, smaller in dimension, basic fabrication and compliance. Due to their short size and planar structure microstrip, they are used in the various utilization such as radars, telemetry, navigation, radio frequency identification (RFID), biomedical systems, mobile and satellite communications, missile systems, a global positioning system (GPS) for remote sensing, etc. The universal design of MPA mainly consists of three components i.e., patch, substrate and ground plane. A copper made part of is called a radiating patch is and is attached on the upper layer while the ground plane is placed on the lower layer of a dielectric substrate.

These antennas can be designed into various patterns and shapes depending on the requirement of the parameters. Patch antennas can be of Square, Rectangular, Triangular and circular shapes as well [13].

Antenna	***Gain (dB)***	***Return Loss***	***Directivity***	***Polarization***
H-Shaped	2.55	-23.72	5.02	1.36
F-Shaped	5.43	-3.98	5.4	2.76
T-Shaped	7.08	-4.3	7.4	6.07
E-Shaped	7.22	-15.62	7.06	3.34

Table 1: Different Shapes of Patch Antenna[13]

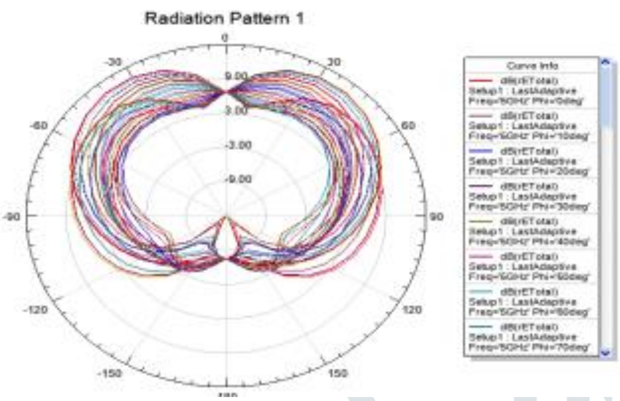

Figure 2: Radiation Pattern of H-shaped

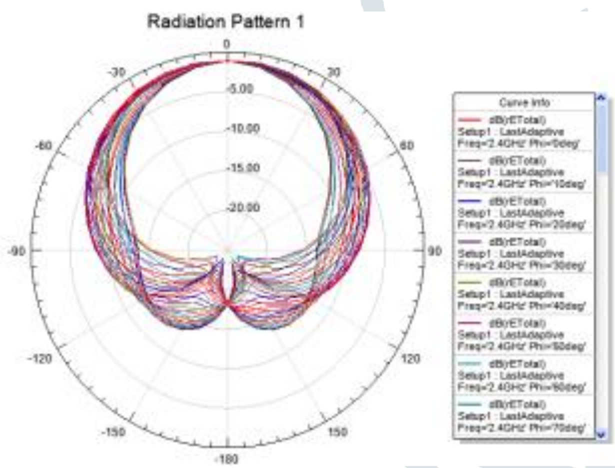

Figure 3: Radiation Pattern of F-shaped

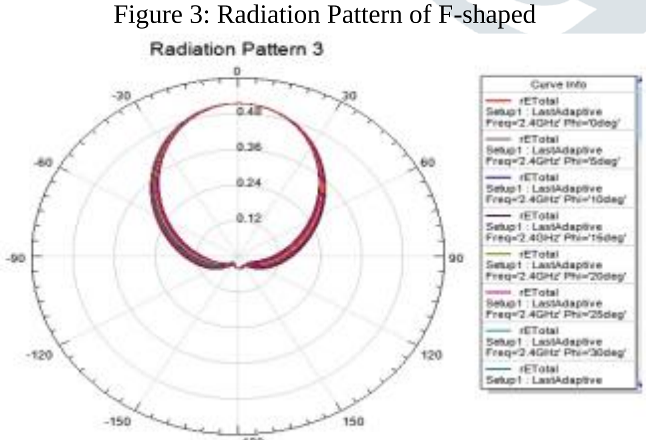

Figure 4: Radiation Pattern of T-shaped

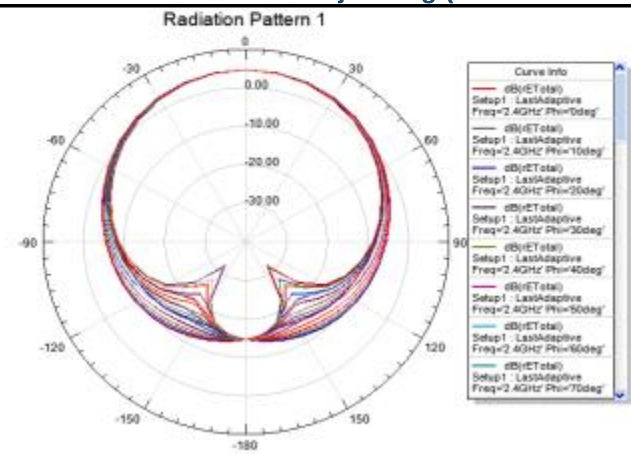

Figure 5: Radiation Pattern of E-shaped

These different shaped-antennas produce varying characteristics as the design parameters are changed. The variations in design parameters highly affect specially, the gain, RL, and direction of power radiations. Among the tested shapes, we conclude that Eshaped MPA is more suitable for the practical applications.

IV. Discussion and Conclusion

In conclusion, in this paper, an Omni-directional antenna fed by double printed monopole, which is operating at frequency 2 to 10 GHz, is presented. The proposed antenna array can be used in ultra-wideband communication. The further investigation which can improve the array performance will be focused on optimizing array parameters such as element shape and their spacing, feeding network, reflection plane height, etc.

V. Expected Outcomes

Our approaches to outcomes for an investigation on a novel ultra wide-band double-sided printed dipole array antenna. The array will be fabricated, analyzed and successfully optimized for improving the performance. Different parts of the array architecture that affect the performance, such as the launcher system and a wide-band balun and array height over the ground plane, will try to investigate. An excellent correlation between simulated and measured radiation patterns will be obtain. Antenna is simulated using CST Studio Suite Software.

VI. Acknowledgeement

Expression of giving thanks is just a part of those feelings which are too large for words but shall remain as memories of beautiful people with whom I have got the pleasure of working during the completion of this work. I am grateful to Dehradun Institute of Technology, Dehradun, India, which helped me to complete my work by giving an encouraging environment. I want to express my deep and sincere gratitude to the HOD of Digital Electronics department of Dheradun Institute of Technology, Dehradun. His comprehensive knowledge and his logical way of thinking have been of great value to me. His understanding, encouraging, and personal guidance has provided a sound basis for the present work.

REFERENCES

1. T.-Y. Wu and K.-L. Wong, "On the Impedance Bandwidth of a Planar Inverted-F Antenna for Mobile Handsets", Microwave and Optical Technology Letters, Vol. 32, pp249-251, 2002

2. The Nan Chang and Yu Chen We ," Proximity-Coupled Microstrip Reflect array", IEEE Transactions on antennas and propagation, vol. 52, no. 2, 2004.

3. Zhen Tu, Guang-Qiu Zhang, Dong-Fang Zhou, Feng Xing , "A wideband elliptic printed dipole antenna array", 4th IEEE International Symposium on Microwave, Antenna, Propagation and EMC Technologies for Wireless Communications, 2011.

4. Krittaya Chawanonphithak , Chuwong Phongcharoenpanich , Sompol Kosulvit , Monai Krairiksh, "5.8 GHz Notched UWB Bidirectional Elliptical Ring Antenna Excited by Circular Monopole with Curved Slot", Asia-Pacific Microwave Conference,2007.

5. Debdeep Sarkar, Kumar Vaibhav Srivastava, Kushmanda Saurav, "A Compact Microstrip-Fed Triple Band-Notched UWB Monopole Antenna", IEEE Antennas and Wireless Propagation Letters,Vol 13, 2014.

6. Ahmed A. Ibrahim, Hesham F. A. Hamed, Mohammed Alla El-Din, Azhar Abdel-alla, Eman Yahia, "A compact planer UWB antenna with band-notched characteristics", Engineering and Technology (ICET) 2014 International Conference on, pp. 1-5, 2014.

7. Osama M. Haraz, Ayman Elboushi, Abdel-Razik Sebak ,"Analysis and design of UWB elliptical slot antennas", 14th IEEE International Symposium on Antenna Technology and Applied Electromagnetics & the American Electromagnetics Conference, 2010

8. Kai-Wen Yang, Fu-Shun Zhang, Chao Li ,"Design of a Novel Wideband Printed Dipole Array Antenna", Cross Strait Quad-Regional Radio Science and Wireless Technology Conference (CSQRWC),ISBN: 978-1-5386-6423-0, 2018.

9. Dongling He, Peng Zhao, Xiaodong Huang, "Novel high gain and compact UWB antenna using multiple radiation arms loaded with rectangular patches", Ubiquitous Wireless Broadband (ICUWB) 2016 IEEE International Conference on, pp. 1-3, 2016.

10. Byoung Nam Kim and Seong-Ook Park, "A Wideband Built-in Antenna with Omni-Directional Radiation Pattern using Dual Radiators for Wireless Terminals", Asia-Pacific Microwave Conference Proceedings, ISBN: 0-7803-9433-X, 2005

11. S. B. Sharma , Dhaval A. Pujara , S. B. Chakrabarty , V. K. Singh, "Improving the Cross-Polar Performance of an Offset Parabolic Reflector Antenna Using a Rectangular Matched Feed", IEEE Antennas and Wireless Propagation Letters, Vol 8, 2009.

12. Kaushik Debbarma , Ratnajit Bhattacharjee, "Microstrip Antenna Feeds for Offset Reflector Antenna for Cross-polarization Reduction at both Diagonal and Asymmetric Planes", IEEE Indian Conference on Antennas and Propogation (InCAP), 2018.

13. Asif Ali Bhoot, Aqeel Ahmed, Dr. Sajjad Ali Memon, Saqib Hussain"Comparative Study of Microstrip Patch Antenna with Different Shapes and its Application", 2nd International Conference on Computing, Mathematics and Engineering Technologies – iCoMET, 2019.

14. B. Stockbroeckx , A. Vander Vorst, "Copolar and cross-polar radiation of Vivaldi antenna on dielectric substrate", IEEE Transactions on Antennas and Propagation, Vol 48, 2000.

15. P. Ramanujam, P.H. Law, D.A. White, "An adaptable dual-gridded reflector geometry for optimum cross-polar performance", IEEE Antennas and Propagation Society International Symposium (IEEE Cat. No.02CH37313), Vol 1 2002.

16. Deepak Bhatia1, Dr. Mithilesh Kumar2, and Amitabh Sharma3, "A Beam Scanning UWB Antenna System for Wireless Applications" International Journal of Electronics Engineering, 3 (1), 2011, pp. 11– 16.

17. Zarreen Aijaz1&S.C.Shrivastava, "Effect of the Different Shapes: Aperture Coupled Microstrip Slot Antenna" International Journal of Electronics Engineering, 2(1), 2010, pp. 103-105.

18. Ahmed Al Shaheen and Hussain Al-Rizzo, "An Ultra Wide Band Antenna Design for Indoor Geolocation Applications" World Applied Sciences Journal 12 (8): 1321-1326, 2011.

19. M. Ojaroudi, Sh. Yazdanifard, N. Ojaroudi, and R. A. Sadeghzadeh, "Band-Notched Small Square-Ring Antenna With a Pair of TShaped Strips Protruded Inside the Square Ring for UWB Applications" IEEE Antennas and Wireless Propagation Letters, Vol. 10, 2011.

20. Ting Fu, Bo Hu, "A new kind compact omnidirectional antenna for wireless communication system". Anti-counterfeiting, Security and Identification, 2008. ASID 2008. 2nd Interntional Conference on Publication Date: 20-23 Aug. 2008.

21. SystemJyoti R. Panda, PrasaduKakumanu and Rakhesh S. Kshetrimayum, "A Wide-band Monopole Antenna in Combination with a UWB Microwave Band-pass Filter for Application in UWB Communication"Annual IEEE India Conference (INDICON) 2010.

22. Seok H. Choi,1 Jong K. Park,1 Sun K. Kim,1 and Jae Y. Park," A new Ultra-Wideband antenna for UWB applications" Microwave and Optical Technology Letters ,Vol. 40, No. 5, March 5 2004 [399-401].