ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 2, February 2019

Antenna Designing For 5G Communication

V.Manimala [1], V. Gayathri [2], R. Dhivya Bharathi [2], R. Dinesh Kumar [2]

Assistant Professor, Department of ECE, Builders Engineering College, Tirupur, Tamilnadu, India[1]

Student, Department of ECE, Builders Engineering College, Tirupur, Tamilnadu, India[2]

ABSTRACT: The Higher frequency spectrum prevalence of the next generation of mobile communication, as well as other new service applications, will likely be dependent upon new advanced antenna technologies. In this regard, the narrow beam widths generally associated with antennas at higher frequencies has led to the study of using Rectangular Micro-strip antenna. With the potential of higher frequencies most 5G frequency bands are predicted to be in the range of 20-50GHz. More specifically the frequency band of 5G is predicted to be extended from 28GHz to 38GHz.In this paper, our goal is to analyze the design of Micro-strip patch Antenna with a rectangular slot for future 5G mobile phone applications. The proposed Antenna has the characteristics of increasing the spectrum efficiency, using low cost FR-4 Substrate, provide higher data rates, adequate reasonable coverage for mobile broadband services,resonates at 5.8GHz Frequency, very small voltage standing wave ratio and has the gain >10dB.

KEYWORDS: Antenna, fifth generation, Micro-strip patch Antenna, FR-4 Substrate

I. INTRODUCTION

Recently the use of mobile phones is wide spread in our society. As a universal part of daily work and personal life, the development of the mobile phone device entails the opportunity to examine how technology drivers are pushing for the integration of real life with mobile technology in future.

Inthe last few years, wireless telecommunications market has recognized as one of the most dynamic and fastest growing segments of the global telecommunications industry.In this regard, the world has witnessed four generations of mobile communication technology, with each new generation extending the capabilities and enhancing the end-user experience compared to the previous generation. From this point of view, global system of mobile communication has many developments starting from 1G passing by several modifications till the emerging of 4G. These versions introduce many services including voice, text, and multimedia. 3G and long term evolution (LTE) have the characteristics of transmitting and receiving data with high rate. However, there is an increasing demand on that rate to become higher and higher to reply the future requirements. So, we are going forward towards next generation, 5G, which will integrate all different technologies in such a way that the global service will be enhanced. These serviceinclude higher mobile data volume per area, huge number of connected devices, longer battery life for low power devices, five times reduce end to end latency, and user data rate which is higher 10 to 100 times than the existing one. Generally, the 5G cellular networks are expected to meet high-end requirements. These networks would provide novel constructions and techniques beyond state-of-the-art architectures and technologies. In telecommunications, a micro-strip antenna usually means an antenna fabricated using micro-strip techniques on a printed circuit board (PCB). It is mostly used at microwave frequencies. This type of antennas has become very popular in recent decades owing to its thin planar profile which can be incorporated into the surfaces of consumer products, aircraft and missiles, its ease of fabrication using printed circuit techniques, its simplicity of integrating on the same board with the rest of the circuit, and the possibility of adding active devices to the antenna itself to make active antennas.The patch structure is the most common type of micro-strip antenna. This kind has been selected owing to its small size, light weight, low cost and ease of fabrication as well as integration with complex circuitry. However, the conventional micro-strip patch antenna inherently has a narrow bandwidth and low gain. For this reason, there are many broadband patch antennas that are designed for bandwidth enhancement. Some of the designs include patch with substrate integrated waveguide (SIW), multi-layer and multi-patch designs, different shape with multi-slotted patch and so on.However, various shapes of slotted antenna are frequently employed to improve the performance of the antenna because of their structural simplicity. Micro-strip patch antennas can be fed by a variety of methods.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 2, February 2019

These methods can be classified into two categories: contacting and non-contacting. In the first one, the RF power is fed directly to the radiating patch using a connecting element such as a micro-strip line. In the second technique, on the other hand, a coupling electromagnetic field is created to transfer power between the micro-strip line and the radiating patch. Here, we are concerned with the contacting scheme in implementing an array of micro-strip antennas the elements of which can be fed by a single line or multiple lines in a feed network arrangement. The proposed antenna can be implemented using low cost FR-4 substrates and it can maintain accepted and good performance in terms of gain and efficiency. In addition, it has response of less than -10dB in the frequency range 5.8GHz. The rest of the paper is organized as follows. Then it describes the design approach of antennas and the behaviour of single patch antennas aiming for future fifth generation (5G) mobile phone applications. It is also concerned with displaying our simulation result.

II. DESIGN METHODOLOGY

Dimensions of a Micro-strip patch antenna depend on the resonant frequency. The rectangular micro-strip patch antenna shown in Fig. 1 is normally consists of a rectangular metallic radiating patch of size Lp×Wpincorporated to one side of a dielectric substrate of size Ls×Ws with relative permittivity Ɛr and thickness h, which has a metallic ground plane on the other side. The radiating patch, which can take any possible shape as well the feeding network, which could be implemented with different techniques are usually photo-etched on the dielectric substrate.
Micro-strip antennas are used for number of wireless applications such as WLAN, WI-FI, Bluetooth and many other applications. The substrate should be chosen carefully because the substrate height as well as its dielectric constant play great roles on the antenna performance and its total size. The substrates that are most desirable for good antenna performance are the thick substrates whose dielectric constant is low, these provide better radiation efficiency, higher directivity, and wider bandwidth, but at the expense of larger element size.

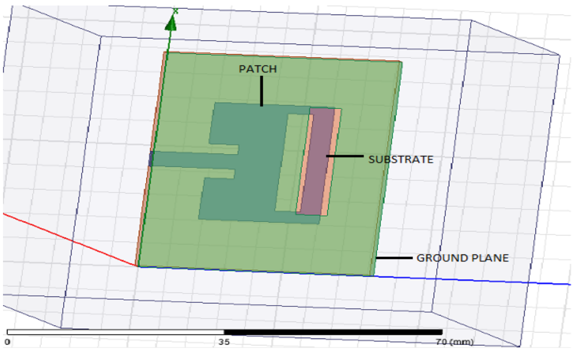

Fig 1: Micro-strip antenna with rectangular slot

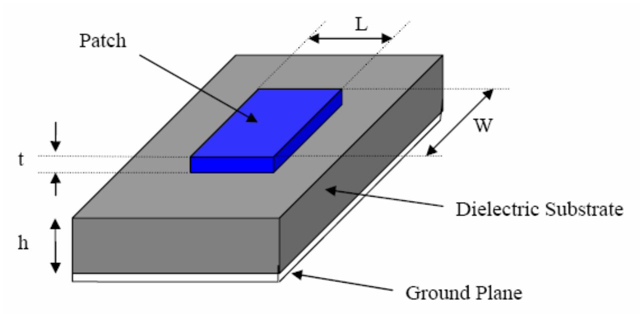

Fig 2: Micro-strip patch antenna

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 2, February 2019

Design Procedure:

For designing of a Micro-strip patch antenna, the resonant frequency and a dielectric medium for which antenna is to be designed, is selectedthe parameters are calculated as,

Width of the patch(W):

The width of the patch is calculated using the equation,

$$W=\frac{Co}{2fr}\sqrt{2/(\varepsilon r+1)}\quad(1)$$

Where,

W = Width of the patch

Co = Speed of light

Ɛr = Value of the dielectric substrate

Effective refractive index:

The effective refractive index value of a patch is an important parameter in the designing procedure of a micro-strip antenna. The radiations travelling from the patch towards the ground pass through air and some through the substrate. Both the air and substrates have different dieletric values, therefore in order to account this we find the value of effective dielectric constant. The value of the effective dielectric constant is,

$$\varepsilon reff=\frac{r+1}{2}+\frac{r-1}{2}\left[1+12\frac{h}{W}\right]^{-1/2},\ W/h>1\quad(2)$$

Length:

Electrically the size of the antenna is increased be an amount of (ΔL).Therefore the length of the patch is,

$$\frac{\Delta L}{h}=0.412\frac{(reff+0.3)\left(\frac{W}{h}+0.264\right)}{(reff-0.258)\left(\frac{W}{h}+0.8\right)}\quad(3)$$

Where ‘h’ =height of the substrate

The length(L) of the patch is now to be calculated using the below mentioned equation,

$$L=\frac{Co}{2fr\sqrt{reff}}-2\Delta L\quad(4)$$

Length and Width of Ground plane:

The length and width of a substrate is equal to that of the ground plane. Then it is calculated as,

Lg = 6h+L(5)

Wg = 6h+W(6)

Return Loss:

Return Loss is the difference in decibels between the incident and reflected signals,

R(dB) = 20log(VSWR-1)(VSWR+1)(7)

III. SIMULATION RESULTS

When the designed antenna is simulated by using HFSS the return loss and the VSWR are calculated from the results obtained than it is observe that the designed antenna is having a band frequency operation of 5.8GHz with -17.5dB return loss. The voltage VSWR standing wave ratio

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 2, February 2019

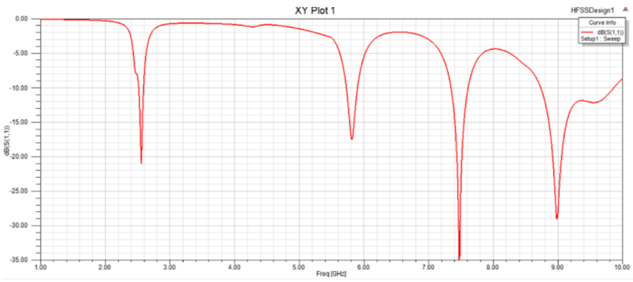

Fig 3: The Return Loss

is1.5dB. This indicates the impedance matching between the field and the load on VSWR then the value should be equal to 1 in an ideal situation but not realizable practically. In other words, practically it should be less than 2 but greater than 1 for good operation of the antenna. Simulated results of 3D Radiation pattern is also represented in this design. Radiation pattern refers to the direction of the electromagnetic waves radiates away from the antenna. It is a graphical representation of radiation properties of the micro-strip patch antenna. The radiation patterns of the antenna isomnidirectional.

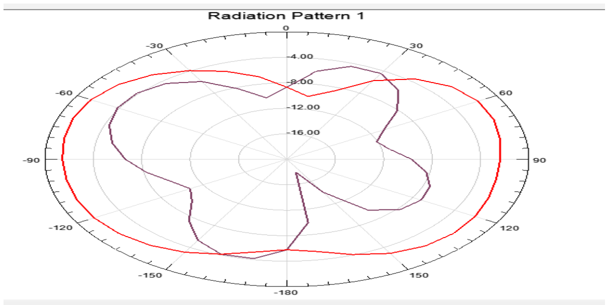

Fig 4: The Radiation Pattern of antenna

The antenna should not have the side lobes and back lobes ideally. It cannot removed completely but can be minimize. Micro-strip antennas can provide directivity in the range of >10dB. Figure 6 shows the simulated 3-D radiation pattern with directivity of 2.97 dB. For proposed antenna configuration at the resonating frequency of 5.8 GHz.

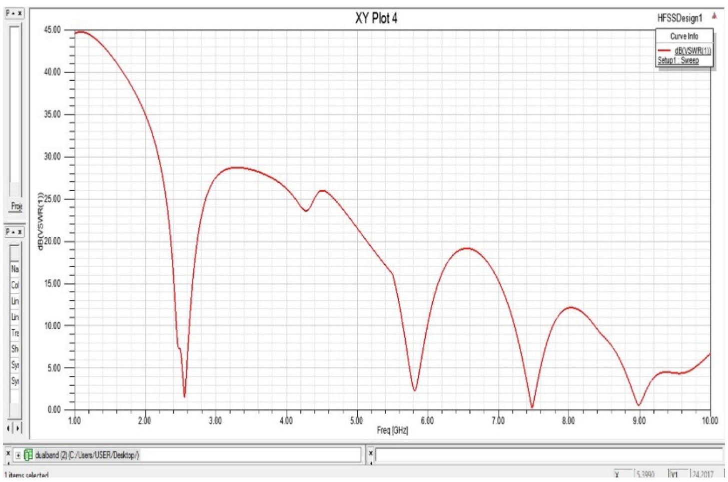

Fig 5: The VSWR of Antenna

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 2, February 2019

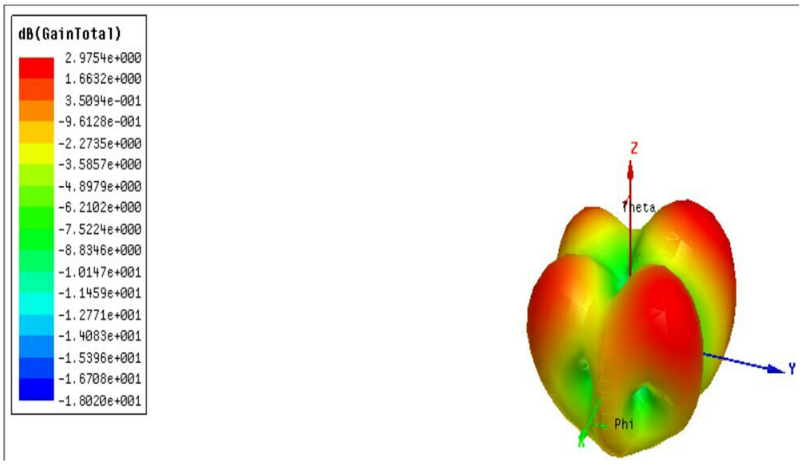

Fig 6: 3D Gain total

IV. CONCLUSION

The antenna is having return loss of -17.5dB at 5.8GHz. This designed antenna is simulated on HFSS software. For this antenna, a sufficient band-width was achieved by utilizing micro-strip line technique, the desired frequency 5.8GHz is achieved. Likewise the VSWR value of 1.5 is achievable. The structure is built on FR-4 substrate of 4.4 dielectric constant. The proposed antenna is very compact, very easy to fabricate. The designed micro-strip antenna is optimized for 5G communication. Further the Gain and directivity of antenna can be improved by using mete-materials into the path.

REFERENCES

1. Mohamad Bakryel_Mashade& E. A. Hegazy, **Design and Analysis of 28GHz Rectangular Micro-strip Patch Antenna Array,**january 2015.
2. Atima Agarwal**, Simulation and Analysis of 5G Mobile Phones Antenna,**septemper 2016.
3. Atik Mahabub1, Md. Mostafizur Rahman1**, Design of a Multiband Patch Antenna for 5G Communication Systems,** at 2018.
4. J.J. Tiang, M.T.Islam, N. Misran, and J.S.Mandeep,**Circular Micro-strip Slot Antenna for Dual Frequency RFID Application**, Progressive Electromagnetics Research, 2011
5. N. Saini and V. Kumar, “A Review on Microstrip Patch Antenna for UHF RFID Tag Applications Mounted on Metallic Surface,” Int. J. of Electrical & Electronics Engineering (IJEEE), Vol. 1, Issue 2, April 2014, pp. 14-18.
6. P.A. Nawale1, Prof. R.G. Zope, **Rectangular Micro-strip Patch Antenna For 2.4 GHz and Communication Using Defected round Structure.**
7. Shera Prabjyot Singh1, Ashish Singh2, **Design and Fabrication of Micro-strip Patch Antenna at 2.4 Ghz for WLAN Application using HFSS,** at 2016.
8. Ehab K. I. Hamad, **Design and Implementation of DUAL-BANDMicro-strip Antennas for RFID reader application.**