CPW FEED MICROSTRIP PATCH ANTENNA DESIGN FOR FUTURE 5G COMMUNICATION

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Abstract: In this paper a microstrip patch antenna is designed using CPW feed that can be used for fifth generation of technology of mobile phone. Antenna having resonant frequency of 3.73GHz, 5.56GHz, and 8.4GHz .This antenna is suitable for WLAN, WSN, Wi-Fi/Wi-Max, HiperLAN. Proposed antenna is designed with fractal antenna technique with good performance in terms of antenna gain, return loss, VSWR, bandwidth, current distribution, radiation pattern. The microstrip antenna is designed using HFSS software.

Keywords: CPW feed, microstrip patch antenna, S11, VSWR, Current distribution, Radiation pattern, gain

I. INTRODUCTION

Wireless communication is very active area of technology, in past few year mobile wireless technology experiences various generations from 0G to 4G technology. Mobile has become very essential part of our everyday life[1].The wireless telephone started with 0G which refers to the pre-cell phone mobile telephone technology such as radio telephone. Technologies used in 0G system included PTT, MTS, IMTS, and AMTS. First generation of wireless communication is more popularly known as cell phones. It is an analog cellular system working in a band of 150 MHz. Technologies used in 1G system are PTT, MTS, IMTS, AMTS. 2G is a digital cellular system. which uses the bandwidth range of 30-200 KHz. Technologies used in 2G systems are SMS, GPRS, CDMA, GSM and EDGE. 3G wireless communication is also known as International Mobile Telecommunication 2000 or IMT 2000. It operates in the range of 2100 MHz and has a bandwidth of 15-20 MHz 3G technologies used in 3G communications are wideband CDMA, WLAN, Bluetooth, UMTS, HSPA. 4G cellular system and at present it is struggling to meet its performance goal. 4G works in an operational frequency of 2-8 GHz Technologies used under 4G are, GSM/EDGE and UMTS/HSPA, Multiple in Multiple out (MIMO) smart antenna technology, Orthogonal Frequency Division Multiplexing (OFDM), Worldwide interoperability for Microwave access (Wi-Max)[2]. But the performance of above generation is unable to solve the unending problem of poor coverage, bad interconnectivity, poor quality of service and flexibility[3]. To fulfill these tradeoffs 5G have to be developed. The major advantages of 5G network is to provide number of services to the end user by improving coverage range and higher data rate, large bandwidth, has improved security features, provide high resolution for cell phone user, 5G provide support for interactive multimedia, voice, video, internet and other broadband services like this lot of improvement is made. 5G Communication is an advanced technology which connect entire world without any limit[4-5]. Overall 5G has best quality of service with most powerful technology, but the main reason of increase in demand of 5G technology is it reduces size of an antenna; it is light in weight so it reduces size of an handheld system[6]. During the movement of the user handheld device gain radiation pattern and input impedance change, the antenna used for the handheld device is a crucial element which can improve or limit the system performance in term of beam width and bandwidth and efficiency. Therefore antenna should be design carefully. For this one type of antenna which can fulfill the wireless system requirement is the microstrip patch antenna. The microstrip patch antenna has low profile, it is light in weight, easy to fabricate, it has high flexibility [7-11]. This antenna is designed by using fractal technology because it has better input impedance matching, operate at wideband/multiband, so instead of use many antenna only one antenna can perform over huge frequency range with miniturazation[12-13]. Proposed antenna is designed using HFSS software [14].

II. STRUCTURE OF AN ANTENNA

A basic rectangular shape is used to design a patch of an antenna with dimension as the length is25mm, width is 1mm and height is 0.1mm. It is designed in such a way that it provides 3.48GHz to 8.80GHz band of frequency. Antenna having resonant frequency of 3.73GHz, 5.56GHz, 8.4GHz with omnidirectional pattern. The antenna has been simulated using Ansoft HFSS simulation software. FR4 dielectric material is used having loss tangent of 0.02, relative permittivity of 4.4, permeability of 1 and conductivity of 0. It is designed with dimension as length is 40 mm, width is 60mm, height is 1.6mm. Ground having a length1 and length 2 of 18.4mm, width1 and width 2 is 10mm, and height is 0.1. The width of the slot of CPW feed is to match the impedance characteristics of 50ohm. In proposed antenna S11<-10decible and 2>VSWR>1.

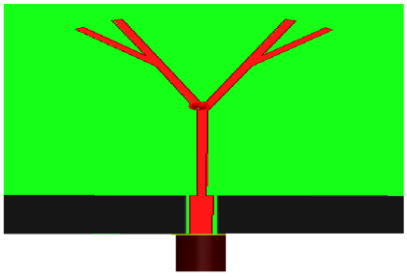

Fig. 1. Proposed antenna with CPW – feed

III. RESULT AND ANALYSIS

A. Return loss of CPW feed microstrip antenna

It is necessary to calculate input and output of signal source because if load is matched then whole power is delivered to load so loss is occurred where return of power is occurred hence it is called return loss. The antenna is giving return loss of -10 decibel at resonant frequency.

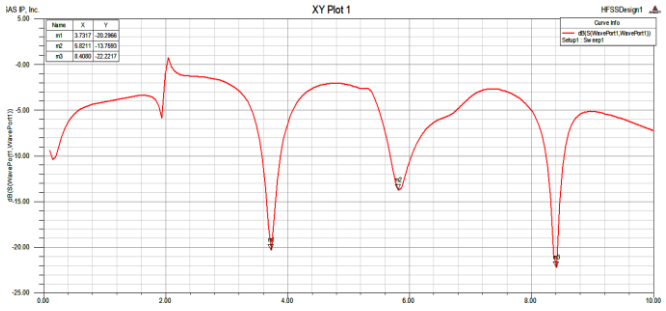

Fig. 2. Simulated reflection coefficient of proposed antenna

B. VSWR of CPW feed microstrip antenna

The graph of VSWR vs frequency is as shown in fig.3

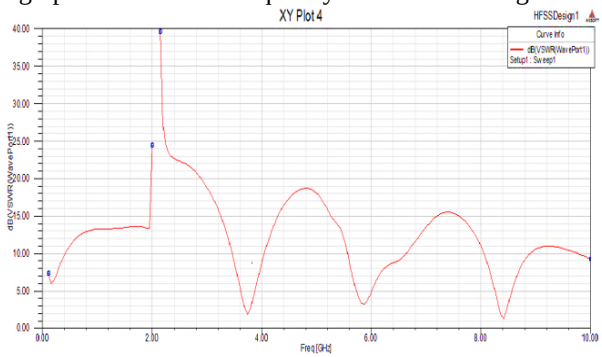

Fig. 3. Simulated VSWR of proposed antenna

C. Radiation pattern

The graph shows the variation of field strength of EM field at all the points from antenna. Radiation pattern shows that it is bidirectional radiation pattern.

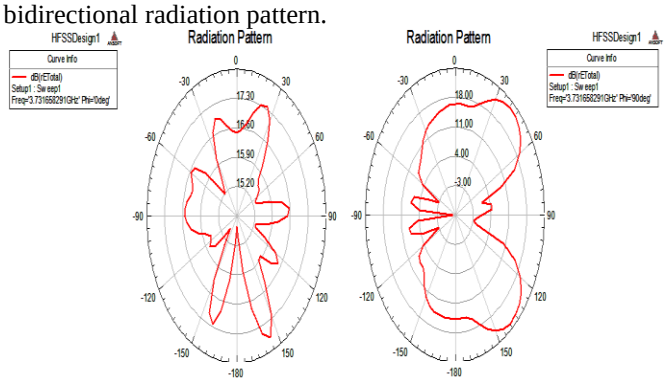

Fig. 4. Simulated radiation pattern of proposed antenna

D. Current distribution

Current distribution of an antenna is shown in fig.5 which shows the maximum value of current is 8000 A/m at given frequency, as the current distribution is calculated at resonant frequency. It indicate that large amount of current is distributed at trunk of the tree for all three frequencies. For 3GHz large current is distributed at main branch also as compared to other two frequency.

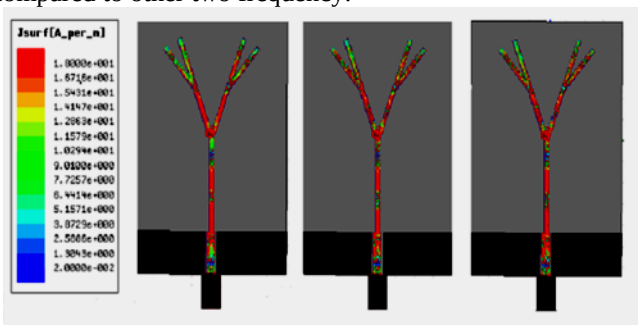

Fig. 5. Simulated current distribution of proposed antenna

IV. CONCLUSION

In this paper, a rectangular patch antenna is proposed using HFSS software, It is operated at bandwidth which can be used for WLAN, WSN, Wi-Fi/WiMax, HiperLAN with compact size. So this antenna can be used for future 5G technology. The obtained result shows that it gives good performance in terms of antenna parameter.

REFERENCES

[1] Mudit Ratana Bhalla, Dr.H.S.Gour, Anand Vardhan Bhalla,"Generations of Mobile Wireless Technology: A Survey",International Journal of Computer Applications, Volume 5– No.4, August 2010.

[2] Meenal G. Kachhavay, Ajay P.Thakare, "5G Technology-Evolution and Revolution: Overview on Generations of Network: 1G,2G,3G,4G,5G", International Journal of Computer Science and Mobile Computing, Vol. 3, Issue. 3, March 2014.
RESEARCH ARTICLE

[3] Vivek Sanghvi Jain, Sanchit Jain, Lakshmi Kurup,"Overview on Generations of Network: 1G,2G,3G,4G,5G",IOSR Journal of Electronics and Communication Engineering, Volume 9, Issue 3, May - Jun. 2014.

[4] Olumuyiwa Oludare Fogbound,"Comparative studies on 3G,4G and 5G wireless technology".

[5] Abhishek Gupta, Dr.Anupam Gupta, Sarthak Gupta, "5G : The Future Mobile Wireless Technology by 2020", International Journal of Engineering Research & Technology, Vol. 2 Issue 9, September – 2013.

[6] Palak Sharma; Megha Verma; Neha Sundriyal & Jyoti Chauhan,"5G Mobile Wireless Technology", International Journal of Research, Vol-1, Issue-9, October 2014.

[7] Indrasen Singh, Dr. V.S. Tripathi; "Micro strip Patch Antenna and its Applications: a Survey", Vol 2 IJCTA, sept-oct 2011.

[8] T.Jayachitra,V.K Pandey and Anshuman Singh, Design of "Microstrip Patch Antenna for WLAN Applications" , International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 3, Special Issue

3, April 2014

[9] R.Vishnu Priyanka R.Mohanamurali, "Design and Implementation of Multiband Antenna for 5G Wireless Networks",International Journal of Research in Engineering, science & Technology.

[10] U. Chakraborty, S. Chatterje, S. K. Chowdhury, P. P. Sarkar, " A comact microstrip patch antenna for wireless communication",Progress In Electromagnetics Research C, Vol. 18, 211,220, 2011

[11] B.Mazumdar, U.Chakraborty, A.Bhowmik, S.K.Chowdhury & A.K.Bhattacharjee, "A Compact Microstrip Patch Antenna for Wireless Communication",Global Journal of researches in engineering Electrical and electronics engineering, Volume 12 ,Issue 5 Version 1.0 ,April 2012.

[12] An Overview' of Fractal Antenna Engineering Research Communications and Space Sciences Laboratory

[13] Nemanja popržen, Mićo gaćanović. "Fractal antennas: design, characteristics and application" Nemanja

[14] Trupti Ingale, A.A.Trikolikar, Gunjan Rathore, P.C.Latane "Simulation of Rectangular Microstrip Patch antenna" International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 1, January 2015.

