International Journal of Modern Electronics and Communication Engineering (IJMECE) ISSN: 2321-2152
Volume No. - 6, Issue No. – 2, March, 2018

Multiband Hexagonal Patch Antenna

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Abstract: In industrial and IT sector, everything is digitalized. For communication and working, LAN's and WAN's is usually being seen in these sectors. For communication purpose we are using different devices attach to our system like (routers, modem) having different bandwidths and it is also being differ country by country. For different networks (LAN, WAN…) and satellite communication, we are using different devices having antenna working in certain bandwidth. A hexagonal antenna is proposed which is compact in size, optimized and operated in wide range bandwidth. It will be emphasized in tertiary sector for different work. Low manufacturing cost and printed board layout are also the pros for this antenna**.**

Keywords: Bandwidth, Hexagonal antenna, LAN, satellite communication

I. INTRODUCTION

For communication purpose, we need such antennas that are compact in size and high gain in certain range of frequencies. Wireless local area networks (WLAN), Wi-MAX (worldwide interoperability for microwave access) and X-band operates for short communication but we need something that is compact, handy and cheap manufacturing cost. For this application, monopole micro striped antenna comes under the picture. Micro striped antenna can be designed easily and in large scale.

The antenna is designed in such a way that its S parameter, return loss and gain is feasible in real time. FR4 substrate is being proposed for the antenna development as its cheap and good response. For the designing of the antenna HFSS software simulator is being used. The simulation of the required parameters are also plotted from the software.

Antenna is suitable for the microwave frequency application that are not possible with the other type of antenna and the high frequency band transmission allow most of the Ku band. Satellite communication for fixed and broadcasting services. Space shutter and international space station such type of communication in the range of (12-18 GHz). In the same frequency, we can see that radar guns are using Ku bands in few cities. For long distance communication, natural disaster prone areas and entertainment especially in remote areas satellite communication comes under consideration.

In literature review, the roundabout circle monopole (CPM) receiving wire has been accounted for to yield wide-impedance data transfer capacity. Examination has been done on the revealed plate with comparative outcomes [1]. A parametric investigation of the hexagonal setups with two distinctive bolster courses of action has been done to contemplate the impact of the encourage hole on the data transmission [2]. planar monopole receiving wires with various bolster indicates are proposed enhance example and the impedance data transfer capacity. A square planar antenna receiving wire including two encourage focuses and an angled variation are planned. These reception apparatuses shows an incredible execution contrasted with existing planner monopoles [3].this paper exhibits the outline condition for bring down band-edge recurrence for all the consistent states of the printed with different encourage position [4].the reception apparatus is then adjusted to have band dismissal at the remove neighborhood (WLAN)(5.1 -5.8 GHz) by a reversal U-shape opening inside the emanating patch[5].planar UWB receiving wires with emanating component are displayed and their data transfer capacity attributes concerning geometrical parameter have been researched[6].a normal structural of the wide-space reception apparatus for wideband roundabout polarization in the view of the coplanar waveguide sustain is displayed[7].In this paper moment cycle sierpinski cover fraction shape UWB receiving wire with limit is exhibited. The reception apparatus covers the recurrence band from 3 GHz to 12 GHz (VSWR <_ 2) [8]. In this letter, a double band fractal antenna radio wire appropriate for long term evolution (LTE) standard is proposed. The reaction apparatus geometry depends on the annoyed planner sierpinski fractal shape, whose geometrical descriptors swarm advancement (PSO) [9].In this paper a normal molded antenna fractal receiving wire for UWB application is planned. In this article, a printed customary normal antenna receiving wire nourished by a micro strip line has been exhibited for ultra wide transfer speed [10].The proposed fractal-like geometry is actualized on a micro strip nourished planar receiving wire [11]. A normal opening radio wire with micro strip nourish is outlined as a kind of perspective reception apparatus and enhanced for is broadband conduct [12].

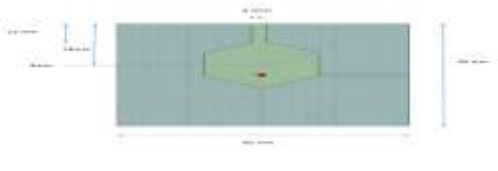


Figure1. 2D view of designed antenna with dimension

II. Antenna Designe And Geometry

The hexagonal antenna is first designed in HFSS software and then simulated. Micro striped antennas that we are going to design is consist of ground, dielectric substrate, patch and micro striped line. During software development-radiation efficiency, gain, bandwidth, impedance and scattering parameter is taken under consideration. The FR4 substrate with 2mm thickness and dielectric constant Er = 4.3 and loss tangent of 0.025. The Hexagonal reference antenna that we are going the design will preferably working on some bandwidth. The impedance of the micro-stripped is 50 ohms for impedance matching. The copper layer thickness is kept to be 0.0017mm.

When the electricity is passed in this open loop antenna then at the port, reflection take place. This factor is determined by the reflection coefficient. For a good antenna the reflection coefficient should be near to zero so that maximum amount of power is radiated. S11 parameter should be more than -20DB.

Table1. Dimensions of the antenna

S. No.	Parameters	Values
1	Height of substrate	2 mm
2	Hexagonal patch	Centre (0,4,2) Start (0, -5,2)
3	Patch width	2 mm
4	Length x Breath	40x 40 mm

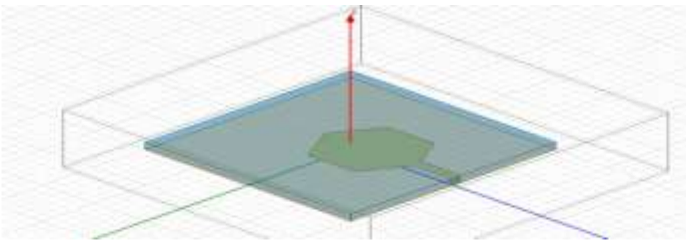


Figure2. HFSS Preview of the designed antenna

In fig 2, there is a hexagonal patch on the substrate which is connected to the feed line. The ground plane is a rectangular copper sheet as shown in fig 2 is connected to the feed line. The boundary condition is verified from the HFSS software. The design is easy and compact in size.

III. Simulated Results And Discussion

The result that are simulated are according to the desired output. From the s-parameter it is clearly seen that the antenna is working in the range of (11.1-18.5 GHz). As shown in the fig 3, it is clearly shown that the s-parameter is good in the above frequency range. From the above figure, the marker m1, m2, m3, m4 states that at the following frequencies the antenna is in the matched state. The antenna is having the good s11 parameter (reflection coefficient) in the above range of frequencies. On the table, the list in the x column are the frequencies and the following s parameters are in the y label.

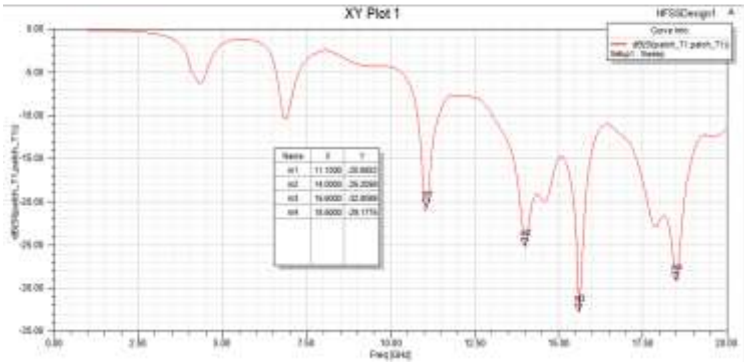


Figure3. S_{11} parameter

Another parameter which is important is VSWR of the antenna. Return loss should be minimum. The value should be near to unity. As shown in the fig 4, the marker indicates the VSWR in the given range of frequency. As it is shown, the values are nearer to unity.

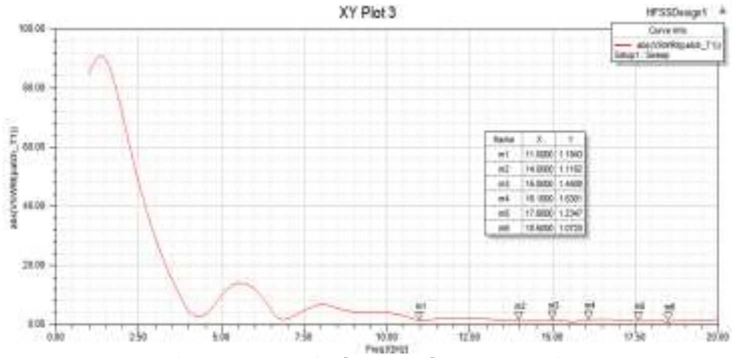


Figure4. VSWR (Voltage standing wave ratio)

The antenna is find to be in its maximum radiating at the frequency 18 GHz as shown in the table 2. From the antenna, peak gain realized from the frequency is 18.42. The frequencies label on the marker have the corresponding gain (11.01 GHZ – 5.0762 DB; 14 GHZ – 6.0596 DB; 15.6 GHZ – 11.514 DB; 18.5 GHZ – 12.036 DB). The Maximum gain observed at 18 GHz is 18.898 DB

Table2. Antenna parameters at 18 GHz

Quantity	Values
Max U	14.944451 mW/sr
Peak Directivity	27.902329
Peak Gain	18.897966
Peak Realized Gain	18.780194
Radiated Power	6.730690 mW
Accepted Power	9.937680 mW
Incident Power	10.000000 mW
Radiation Efficiency	0.677290
Front to Back Ratio	undefined
Decay Factor	0.000000

Quantity	Values	(Theta, Phi)
Total	3.356802 V	(33deg,82deg)
x	2.444741 V	(20deg,335deg)
y	2.859747 V	(29deg,190deg)
z	1.924583 V	(77deg,346deg)

Phi	2.834046 V	(-29deg,8deg)
Theta	3.292591 V	(-33deg,264deg)
LHCP	2.722199 V	(34deg,82deg)
RHCP	2.578289 V	(21deg,201deg)
Ludwig3/	2.582651 V	(21deg,335deg)
Ludwig3/	3.321383 V	(-33deg,263deg)

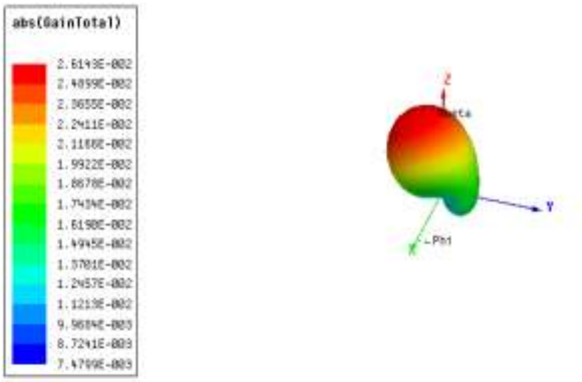
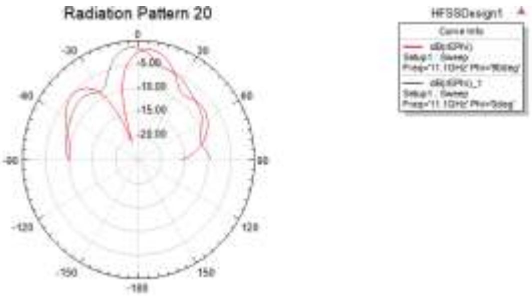


Figure5. 3D polar plot



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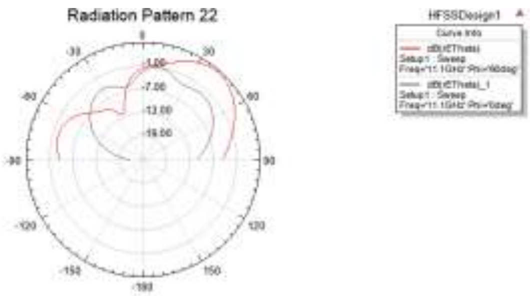
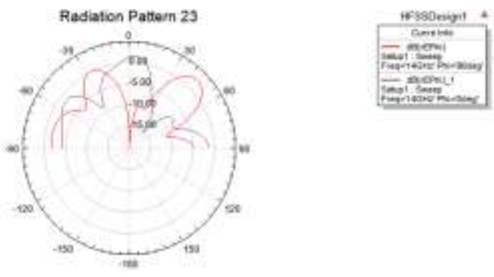


(b)

Figure6.2D radiation patterns at 11.1 GHz. (a) Eϕ at ϕ=90^0 and Eϕ at ϕ=0^0 (b) E_θ at ϕ=90^0 and E_θ at ϕ=0^0



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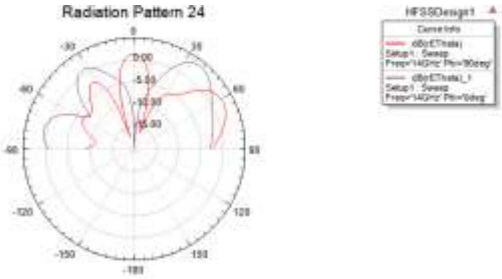
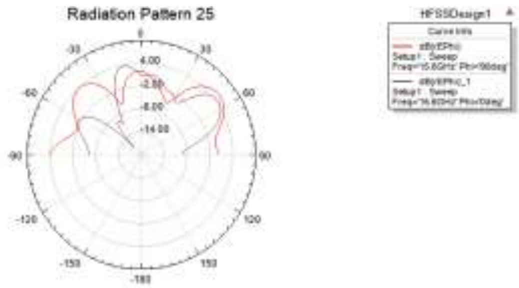


(b)

Figure7.2D radiation patterns at 14 GHz. (a) Eϕ at ϕ=90^0 and Eϕ at ϕ=0^0 (b) E_θ at ϕ=90^0 and E_θ at ϕ=0^0



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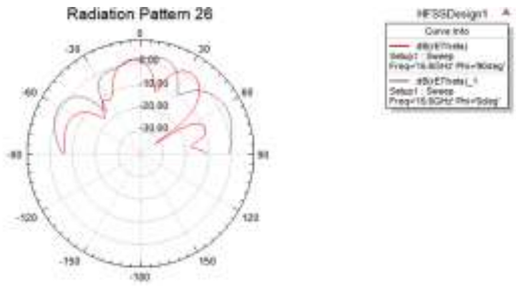
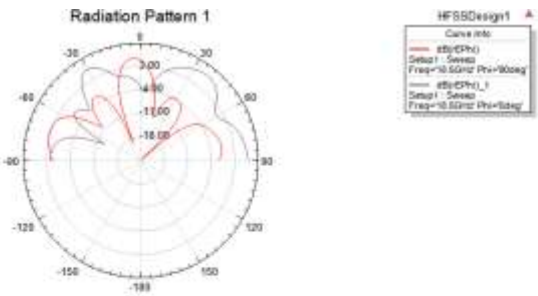


(b)

Figure8.2D radiation patterns at 15.6 GHz. (a) Eϕ at ϕ=90^0 and Eϕ at ϕ=0^0 (b) E_θ at ϕ=90^0 and E_θ at ϕ=0^0



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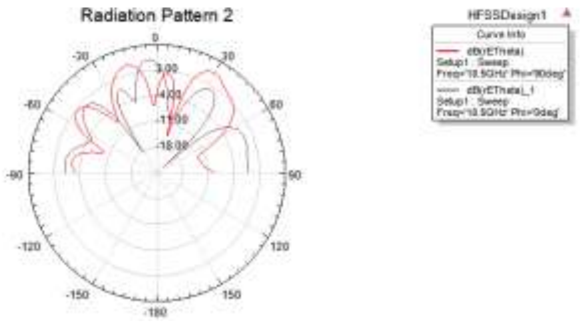
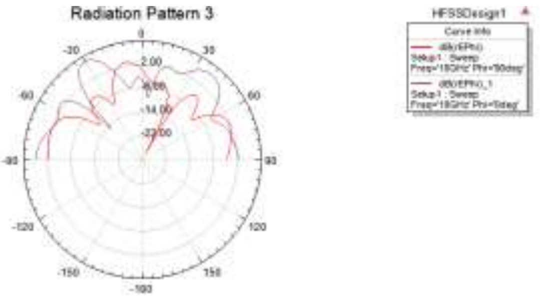
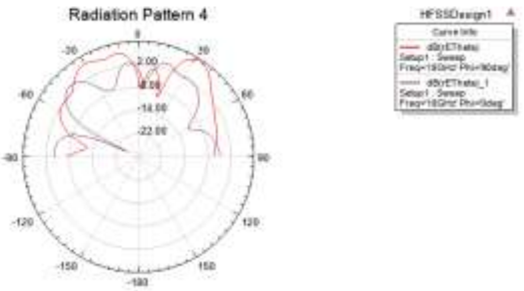


(b)

Figure9.2D radiation patterns at 18.5 GHz. (a) Eϕ at ϕ=90^0 and Eϕ at ϕ=0^0 (b) E_θ at ϕ=90^0 and E_θ at ϕ=0^0



(a)



(b)

Figure10.2D radiation patterns at 18 GHz. (a) Eϕ at ϕ=90^0 and Eϕ at ϕ=0^0 (b) E_θ at ϕ=90^0 and E_θ at ϕ=0^0

The simulated measured radiation pattern of the designed antenna at 11.01 GHz, 14 GHz, 15.6 GHz, 18 GHz and 18.5Ghz are shown above.

IV. CONCLUSION

The results have successfully simulated with good outcome. The hexagonal slot monopole antenna is being designed and the result is analyzed accordingly. The small size micro strip antenna is workable in wide range of frequencies. The gain of the antenna is good with no error in boundary excitation. In the range, it can be used for short communication like in Wi-Fi, WI-MAX, X-band. The antenna is compact in size with high band of communication.

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