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EFFICIENT ANTENNA DESIGN FOR 4G COMMUNICATION SYSTEM

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***Abstract*—A small and compact microstrip patch antenna was designed for 4G communication system. The proposed antenna consists of a rectangular radiating patch, a feed line and a ground plane. The proposed antenna is made to cut into symmetrical L and U shaped slots to obtain the frequency band for 4G communication system. By varying the dimensions of the L and U shaped slots the desired frequency band was obtained. The design of this prototype is fabricated using FR4 substrate material with relative permittivity of 4.4. The proposed antenna has the dimension of 11.40 X 6.5 X 1.6 mm^3 and it is suitable for 4G communication. The antenna was designed by using ADS 2016.01 software. The simulation result shows that the designed antenna is capable of operating over the 7.3GHz resonance frequency. Omni directional radiation pattern and acceptable antenna gain are achieved over the frequency band. The proposed antenna lies in the C-Band and it is used for radar applications.**

Keywords: Microstrip patch, L shaped and U shaped slots, FR4, ADS, C-Band.

I. INTRODUCTION (*HEADING 1*)

Nowadays 4G communication plays a important role in wireless communication. 4G communication also known as fourth generation wireless technology succeeding of 3G. It also known as MAGIC. The data rate for 4G communication system (LTE advanced) with peak upload rate 500 Mbps and the peak download rate 1000 Mbps and bandwidth of 200 Mbps. The fourth generation refers to the evolution of data transfer technologies. The frequency band range is 2-8 GHz. The antenna used for 4G communication system is omnidirectional antenna. To obtain the omnidirectional radiation pattern Microstrip patch antenna is used. Microstrip patch antenna is known as patch antenna or printed antennas. These type of antenna can be easily printed on the circuit board. It can be easily fabricated using Microwave Monolithic Integrated circuit technology. These antenna can be used in Mobile phones for transmitting and receiving radio waves. Nowadays antennas are fabricated using 3D printing technology. These antennas are low profile, mechanically robust to the host surfaces when compared to the planar and non-planar antennas. The gain of the antenna is usually around 6-9dBi. The patch antenna consists of rectangular radiating patch, a feed line and a ground plane. It's a half wavelength long. Microstrip antenna is the narrow beam wideband antenna. The value of the dielectric constant ranges from $2.2 \leq \varepsilon_r \leq 12$. In [1] the microstrip fed wideband antenna with deflected ground structure is used for wimax and wlan applications. The antenna consists of annular ring radiator which is surrounded by a rhombus bus shaped strip and a deflected ground surface. The ground plane is shaped and cut out into rectangular shaped slot and thus formed a deflected ground plane. The operating frequency is about 2-6 GHz. Due to the narrower bandwidth, the capability of the antenna is reduced. In [2] a C-shaped monopole antenna with inverted L-shaped parasitic strip is used. The gain of the antenna is 2.9 dBi and radiation efficiencies about 94%. It does not satisfy the requirements. In [3] a cpw-fed monoplanar antenna is used. The antenna consists of three elements ie. Folded open stub, l-shaped open stub and Y-shaped resonator. The antenna shows a triple band operation and the size of the antenna is large when compared to the other antennas. Moderate gain is obtained. In [4] the antenna consists of a rectangular ring and an s shaped strip is connected to the feedline with a crooked strip and a three strips at the bottom layer. The overall dimensions of the antenna is large than the other antenna types. The antenna exhibits dipole liked radiation pattern in the E-plane and omni directional pattern in the H-plane. The three strips at the back of the antenna makes the impedance matching characteristics. In [5] the antenna square slot resonator and monopole radiator. The resonance can be achieved by its size. If the length of the square slot increases, the frequency band shifts. The perimeter of the square slot has a strong effect on the lower frequency band. The stub plays a role in the impedance matching. It does not satisfy the requirements. The antennas have the advantages of simple structure, wide bandwidth and regular omnidirectional radiation patterns. However, their sizes are too large for the limited space of portable wireless device. In [6] the printed wide-slot antenna fed by a microstrip line with a rotated slot for bandwidth enhancement is used. The printed slot is chosen to square in order to match with the bandwidth requirements. Within this wide impedance bandwidth, with gain variation less than 2 dBi, the operating bandwidth with usable or selectable broadside radiation patterns can be about 1100 MHz, or two times that of the corresponding conventional printed wide-slot antenna. The other ground plane on the strip line of the slot

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serves as a reflector that can provide a additional radiation pattern to the printed Antennas

III. PROPOSED ANTENNA

The schematic configuration of the microstrip patch antenna is shown in the fig 1. The proposed antenna consists of rectangular radiating patch, a feedline, a pair of symmetrical L shaped and U shaped slots and a ground plane. The design of the proposed antenna is based on the microstrip fed monopole antenna that is low profile but relatively large dimensions at quarter guided wavelength at first resonant frequency but does not meet all the requirements. To design a small and compact antenna that provides the omni directional radiation pattern at the 4G communication frequency band the following design procedure has been used. The dimension of the patch antenna is significantly reduced, a pair of symmetrical L-shaped and U shaped slots are designed. The pair of symmetrical L shaped and U shaped slots are made and cut within the patch. The proposed antenna is printed on the FR4 substrate with dielectric constant 4.4, a loss tangent of 0.024 and the thickness of the substrate is 1.6mm. The total dimensions of the substrate is only 11.40 x 6.5 x 1.6 mm.

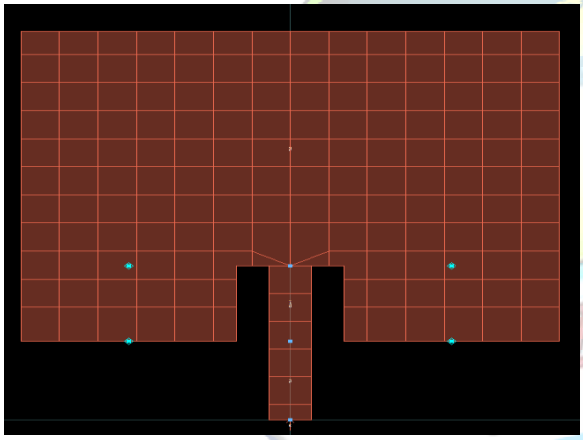

Fig 1: Schematic View of Microstrip Patch antenna.

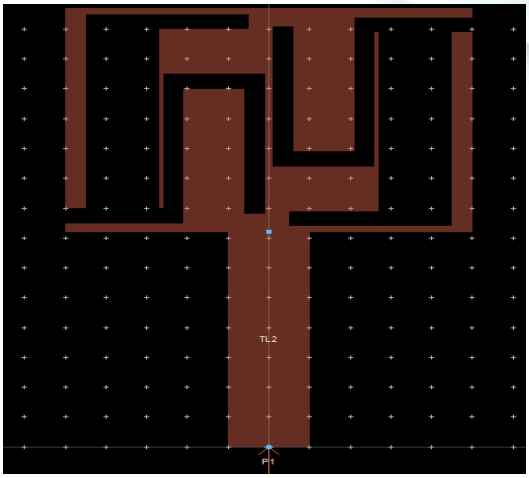

Fig 2: Proposed Antenna with slots

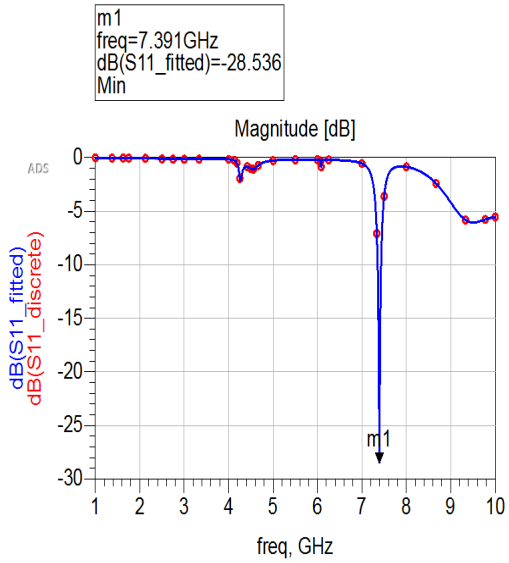

Fig 3: frequency Vs dB.

IV.CONCLUSION

A design of small and compact microstrip patch antenna was sesigned for 4G communication is designed. The proposed antenna consists of a rectangular radiating patch, a feedline, a pair of symmetrical L shaped and U shaped slots. The resonant frequency band obtained is 7.3 GHz. Return loss of the antenna is less than -10dB. Good omnidirectional radiation pattern and radiation efficiency are obtained.

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