International Journal of Modern Agriculture
ISSN: 2305-7246
Volume 9 Issue 3, 2020

A Slotted CPW Monopole Antenna for LTE Application

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***Abstract*—**Here, a circular monopole Coplanar Waveguide (CPW) feed planar radiatoris modeled for LTE application. The designed antenna gives a good impedance matching within the Long Term Evolution Band 2600 MHz. In this work the points of interest considered were the reduced scattering effects, less radiation in undesired directions, and the ability to control the impedance at discontinuities, which when compared with a microstrip composed feed lines. The proposed antenna is fabricated using RT-Duroid through which compactnessis achieved. The overall footprint of the antenna is about 32x28x1.6mm^3. Thegain and efficiency of this antenna was analyzed and was taken to be of moderate for a circular monopole antenna.

Keywords-*Coplanar Waveguide,monopole,slot,microstrip, impedance matching, HFSS*

I. INTRODUCTION

In the last few years, wireless communication system is developing and currently reached 4G systems [1- 3]. In Contrast with previously evolved systems, LTE systems havegreater information rate transfer for the distant and adaptive communication. Similarly 400MHz to 4 GHz range of frequency is allocated for radiocast space and1.4MHz to 20 MHz frequency band is used for point to point mobile communication [4]. In rapid distant communication, like mobile gadgets and information terminals, Long Term Evolution plays a predominant role. Nowadays, compact mobiles are handy and attractive, for such compact devices, radiator cannot be large in size, so the antenna miniaturization is important and at the same time it could be able to operate in multibandwith a simple frame. To solve this problem, to agree with the transmit requirements of LTE band and to compensate the capacity to establish in a restricted space, miniaturized multiband radio wires are the possible choice for in the 0.698– 0.96/1.710– 2.690GHz for the transmission in the LTE/WWAN applications [5-6]. One of the example proposed in [7], describes a printed winded line monopole antenna for LTE applications is designed to operate in the 0.7-GHz. A studyon a complicated geometry [8], is done and found to workin a wide LTE distributed range, from0.7 to 2.6-GHz.

Results obtained in [11], serves to be a better candidate for 4G mobile applications which uses a Planar Inverted F Antenna (PIFA)for single band operation. The totalsize of the proposed PIFA was (21.72mmx18.5mmx4mm)incorporated with rectangular patchetched on a FR4 substrate. 2600 MHz is the desired frequency range covered. Due to its low profile, nominal size and good gain it is suitable for LTE based mobile applications.

Another solution was proposed in [10], in which a microstrip antenna with a rectangular patch is

loaded with parasitic elements to obtain the desired wideband characteristics. The footprint of this antenna is found to be 14cmx12cm, which achieved the operation at 793.66 MHz-2501.34 MHz.

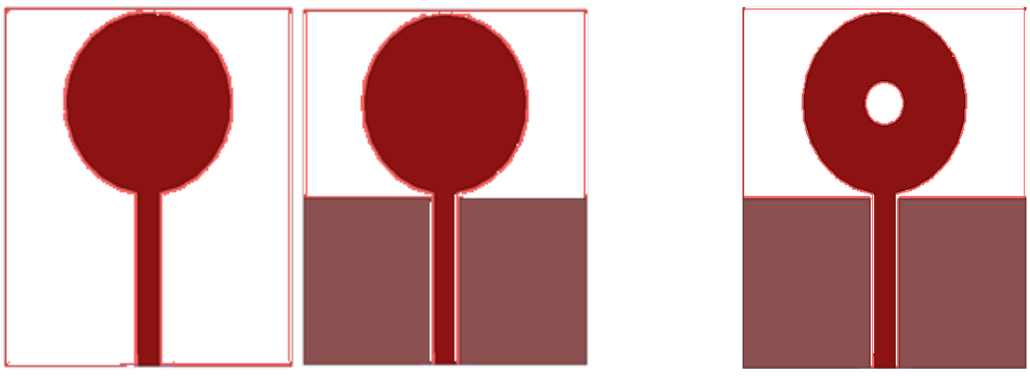
In a recent paper[9], a dual-bandMIMO antenna with 4-port diversitywas designed for LTE applications. The overallfootprint of this antenna is 15 x 25 x 0.16cm^3 which used FR-4 as dielectric material . In this work, the bottom plane is loaded withan inverted L-shaped structure, and arectangular metal stub is loaded on the top plane of the antenna. This antenna found to operate on two frequency bands such as 0.7 GHz and 2.4 GHz. The inverted L-shaped structure helps in producing the first resonance at 0.7 GHz and the rectangular stub for the second resonance at 2.4 GHz, respectively.

As reported by [12] , a PIFA antenna is modeled for mobile handset applications with a 60 × 30× 1.6mm^{3}using FR4 substrate found to offer better impedance matching and covered 1700 MHz to 2370MHz .

Similarly, an array of antenna system has been developed for LTE mobile device application which was about 77 x 7 x 1.6 mm^3 in size. Here a switching circuit was used [13] to switch the antenna operation between the frequency 758 MHz to 960 MHz.

II. SLOTTED CPW MONOPOLE ANTENNA

The objective of the modeled antenna is to operate at the LTE band and achieve better compactness. The antenna design was started from the conventional formula available for designing circular patch antenna.The proposed structures are depicted in figure 1, where iteration(a) consists of circular radiating patch. Here Rogers RT/duroid 5880 substrate is used for designing the antenna, which has apermittivity of 2.2. The configuration (b) consists of Coplanar Waveguide feeding technique, which is to be used for our proposed antenna. This CPW feeding technique exhibits advantages like reduced scattering loss, less radiation spills, etc. In the model shown in figure.1.(c), a slot is introduced in the radiating patch to obtain resonance with better impedance matching characteristics.Figure.2 represents the final proposed configuration and the dimensions of the proposed planar radiator are tabulated in table.1.



(a) (b) (c)

Figure 1: Step by stepevolution of proposed antenna

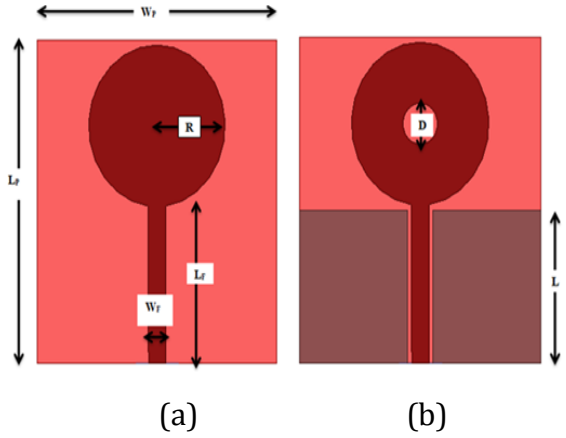


Figure 2: Perspective view of proposed antenna (a) without and (b) with slot.

Table 1: Parameters of Proposed antenna

PARAMETERS	DIMENSIONS(mm)
LP	32
LF	16
WP	2
WF	28
R	8
D	4
L	15

III. SIMULATION RESULTS

In this section the simulated observations are discussed. Figure 3 depicts the simulated reflection co-efficient (S_{11}) for the conventional antenna. Hencethe antenna does not resonate. Further the parametric study was taken using the simulator, where the frequency band of interest is achieved by introducing a slot in the radiating patch and CPW feed, which is depicted in Fig 3(b). The proposed antenna covers the frequency range of 2.6 GHz which will be used for 4G LTE mobileapplications. By loading slot in main radiating element, good impedance matching characteristics was achieved. The loading of slot in the radiating patch helps in achieving better impedance match.The antenna gain being a key parameter of the antenna characteristic representation is obtained as 1.48dB which is plotted in figure 4.

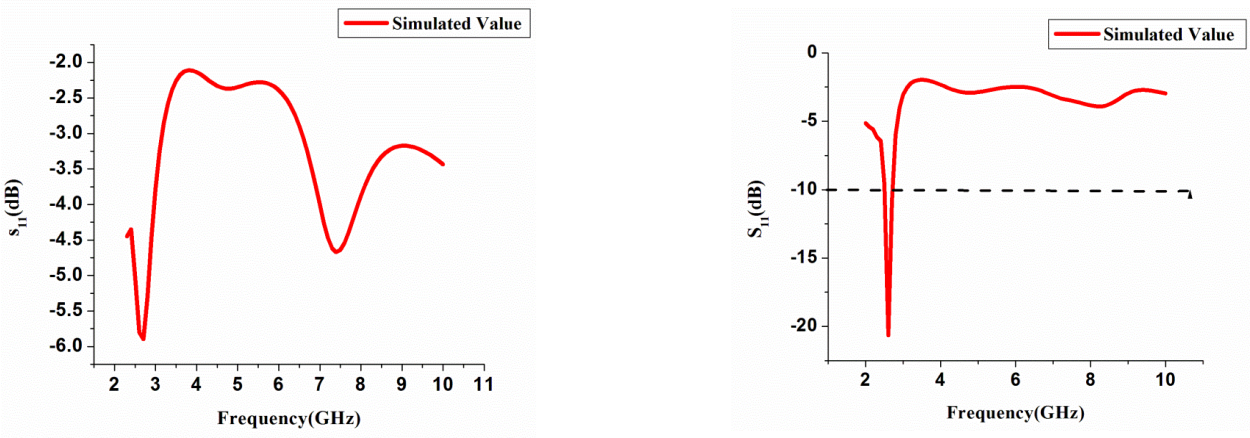


Fig.3: (a) Simulated reflection coefficient for the design without slot , (b) reflection coefficient for design with slot

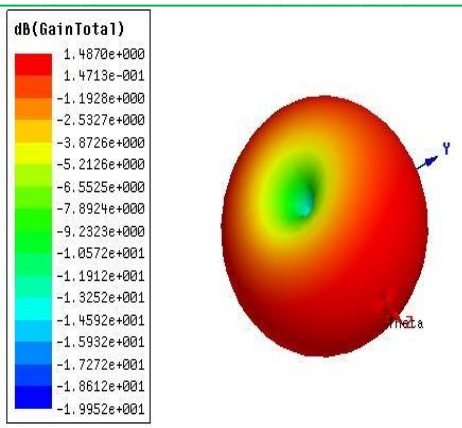


Fig. 4: Gain plot of the proposed antenna

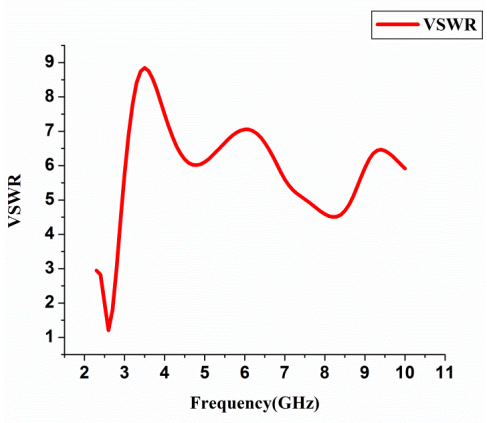


Fig. 5: Simulated VSWR for the proposed antenna

Voltage Standing Wave Ratio(VSWR) is a supporting parameter that indicates the impedance match nature in the antenna, and was found to be between 1 to 2.So Completetransmission takesplace by transmitting the signal entirely to patch without any obstacles i.e,distortion and reflection. From the results discussed, it can be seen that the proposed antenna portrayed as a better candidate for 4G/LTE application.

IV. CONCLUSION

A Circular Patch Monopole antenna with a slot using CPW as transmission line is proposed for 4G/LTE application. The CPW fed patch antenna works with the resonant frequency of 2.6GHz. The proposed antenna had a gain of 1.4 dB . The proposed antenna is optimized for obtaining the required bandwidth for a 4G application, performance parameters like VSWR, f_c, gain. Due to its compact nature and simple framework, the antenna is found to besuitable for handheld mobile devices which operate in LTE.

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