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Wideband Planar Monopole Antenna by CPW-Fed for WLAN/WIMAX Applications

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ABSTRACT: A wideband planar monopole antenna by CPW fed to circular patch is presented for WLAN, WIMAX and various applications. This antenna has very compact in size, has width 35.3mm,length 40mm and height 1.52mm fed with the coplanar waveguide of 50ohm microstrip line where ground is reduced sized, below the substrate. The proposed antenna covers the frequency range of 2.47 GHz to 7.181 GHz range which has impedance bandwidth of around 4.7 GHz and return loss dip is -20dB. The gain is around 2.58 dB and directivity of 2.91dB. The results show that the antenna can achieve wide impedance-bandwidth and Gain simultaneously. The radiation characteristic of the antenna shows the monopole like pattern and the simulated results are in good ones.

Keywords: Monopole antenna, Wideband antenna, coplanar waveguide (CPW) fed, Gain, impedance bandwidth, CST.

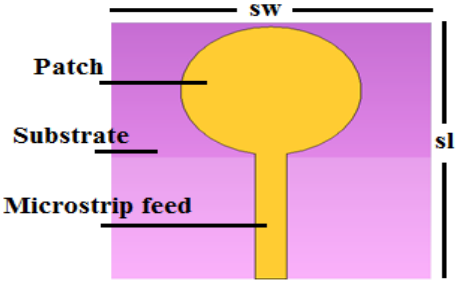
I. INTRODUCTION

It has been well known that the future communication technology pressingly demands integration of more than one communication system in a limited equipment space. The wideband Antenna systems are attracted so much attention because the need of exchanging huge quantity of information at high rates in modern communication system. The planar monopole antenna are so simple in the geometry and very easy to construct by the simple metal. These type of antenna have the advantages of providing wide operating bandwidth and is achieved from placing the metal plate on relative to large ground plane.

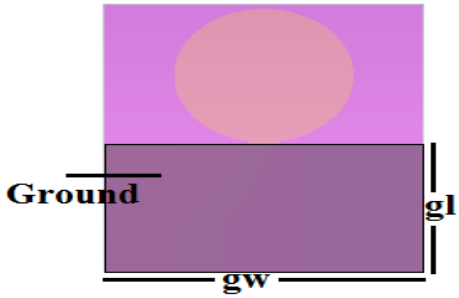
Antennas with compact size, Low profile and simple structures are now a day's very attractive for wireless local area network (WLAN) and worldwide interoperability for microwave Access (WiMAX) communication.In order to meet the specification of the WLAN bands at 2.4 GHz (2.4 GHz to 5 GHz), Wi MAX band at 3.4 GHz, S for 2-4GHz and c-band for 4-8 GHz. Various types of wide and multiband monopole antennas are proposed such as rectangular, triangular slotted and many different shapes [1]. These antenna have wide impedance bandwidth and omnidirectional radiation pattern. A design example of the proposed antenna is demonstrated, and the simulation results are presented. All the results and simulations are performed by the use of CST (Computer Simulation Technology) Microwave Studio software.

II. ANTENNA DESIGN CONSIDERATION AND DESIGN CONFIGURATIONS

The methodology for the antenna is described here in brief manner. Here first to attain wideband operation [2] covering the frequency range of 2.4/5.2/5.8/s-band and c-bands planar monopole antenna are chosen. Second achieve the omnidirectional pattern for 3D coverage for this reduced ground plane has been used. The Design of the proposed wideband monopole Antenna [3] with modified ground surface plane is shown in the Fig. 1. below.



Front View



Back View

Fig. 1. Front and Back view of the proposed Wide Band monopole Antenna.

Aim of the design is to have compact reduced size monopole antenna. The design consist of four main part Patch, Substrate, Ground and Feed (microstrip feedline).The Circular Patch[4] is mounted over the substrate whose radius is 10mm which is perfect electric conductor, below the patch and above ground Substrate is placed whose dimension is 35.3 mm width and 40 mm length and height of 1.52 mm is made up of FR4 material permittivity of 4.3, the ground is located below the substrate having reduced size length of 19 mm and 35.3 mm width, which is also made up of perfect electric conductor metal. The patch has been fed with the coplanar waveguide microstrip feed line[5] that excite the patch for radiation has the width of 3.5mm and length of 19.4 mm.

Table 1: Dimensions for wideband frequency Antenna.

Parameter		Dimension (mm)
Substrate length	Sl	40
Substrate width	Sw	35.3
Ground length	Gl	19
Ground width	Gw	35.3
Substrate height	h	1.52
Feed line length		19.4
Feed width		3.5

III. SIMULATION RESULTS

The design of the antenna is simulated by the CST Microwave Studio software which solve by use of finite element method. The figure below shows the return loss result, which clarify that its max dip approaches to -20 dB, having wide impedance bandwidth of 4.7GHz whose range starts from 2.47GHz to 7.181 GHz which is very wide impedance bandwidth.In the design process, when the primitive geometry of the two planar monopoles are determined, dimensions of the antennas, such as sw, sl, gw, gl, and h in Antenna , are carefully adjusted through an error and trial method for the optimal input impedance over the required frequency band .

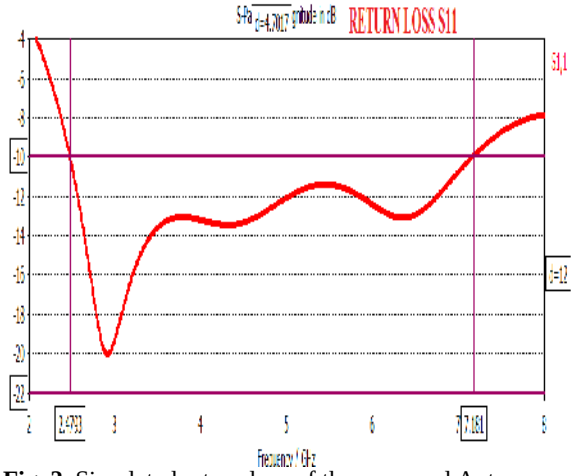


Fig. 2. Simulated return loss of the proposed Antenna.

Table: 2 below shows the important antenna results.

Table 2: Important Parameters at resonant frequency of PRMA CPW-fed for wideband Antenna

Parameter	Results
Bandwidth	4.7 dB
Gain	2.58 dB
Directivity	2.9dB
Return loss S11	-20dB

We can clearly observe the radiation pattern have nice omnidirectional 3D view which resonates its energy to environment with enough power where the directivity 2.9dB, and this pattern provides gain around 2.58dB.

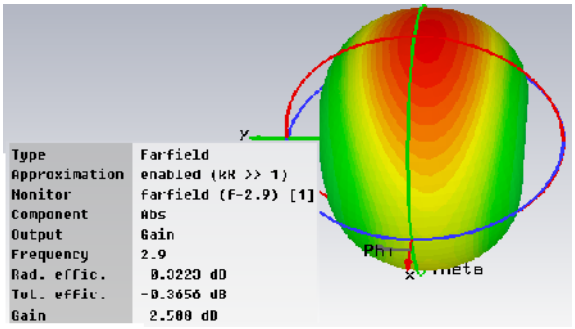


Fig. 3. Simulated antenna Radiation Pattern of gain.

The proposed antenna is analyzed for the important parameters, which affects the bandwidth of the antenna. In this antenna design, the ground width and length of circular monopole patch, mainly affects the bandwidth of antenna. The ground width and length is varied according to the change in the values of impedance bandwidth. Figure below shows the simulated return loss of the proposed antenna with different ground lengthwith all the remaining parameters[6] of the proposed antenna are same as the design shown in Table: 1.

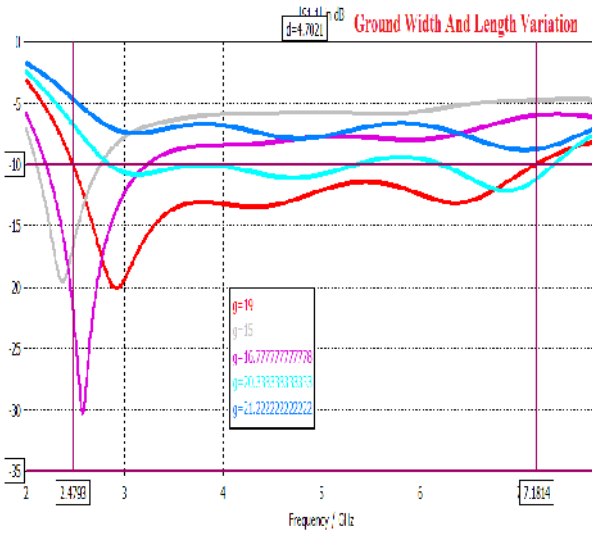


Fig. 4. Simulated return loss of the proposed Monopole antenna as a variation in feed width.

The antenna result VSWR of the proposed circular monopole antenna for wide band applications is shown in figure 6. It is clearly seen from the figure:5 that the antenna VSWR is between 2and 1 and also the Electric field radiation Pattern for antenna is shown in Fig. 6.

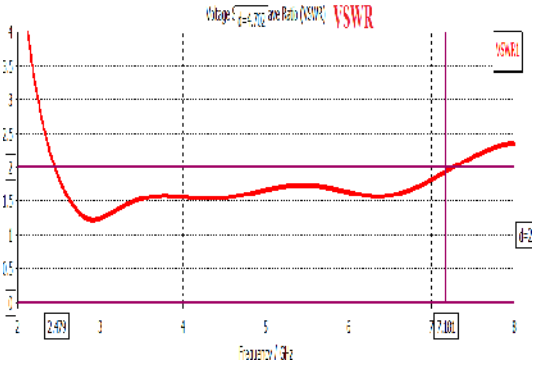


Fig. 5. Simulated antenna VSWRof proposed monopole antenna.

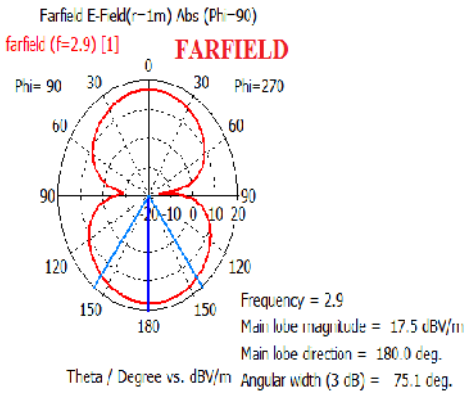


Fig. 6. Simulated antenna E-field radiation pattern of proposed monopole antenna.

IV. CONCLUSION

Wideband planar monopoles attached to reduced sized ground planes which are analyzed, and fabricated. The simulated results shows that the monopole antenna are capable to cover the WLAN bands at 2.4 GHz (2.4 GHz to 5 GHz), Wi MAX band [7] at 3.4 GHz, S for 2-4GHz and c-band for 4-8 GHz frequency range. In the whole operating frequency, the monopole can provide a nearly omnidirectional radiation pattern in the azimuth plane. With relatively low profile, the compact planar monopole have great potential use in multi-band wireless communication systems such as receivers on vehicles. The antenna has been analyzed using a finite element method [8], where the result are achieved by CST Microwave simulator [9]. It is hopeful that the simple structure of the proposed antenna, its compact size, and the degrees of freedom of its design, will make it an attractive choice for the Wideband antenna [10] designers.

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