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Stacked I-shaped slotted novel Microstrip Patch Antenna for GSM, IMT, WLAN, Bluetooth and WiMAX applications.

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Abstract— **This paper presents a novel wideband antenna design for GSM 1800, GSM 1900, IMT, WLAN, Bluetooth and WiMAX applications with a bandwidth of 1.7128 GHz (1.2229 GHz to 2.9357 GHz). The material used for substrate is Teflon having dielectric constant of 2.1 and copper has been used for patch, ground and feed line. The antenna is a dual resonant antenna with resonating frequency of 2.4 GHz and 2.65 GHz with return loss of -54.75 dB and -43.83 dB respectively. The antenna has a gain of 2.97 dB and directivity of 2.92 dBi at resonant frequency of 2.4 GHz. The antenna has gain and directivity of 4.01dB and 3.98dBi at resonant frequency of 2.65GHz respectively. The performance of the antenna has been analyzed in terms of return loss (dB), directivity (dBi), gain (dB), smith chart and VSWR.**

***Index Terms* — Bluetooth, dB, dBi, GHz, VSWR.**

I. INTRODUCTION

Communication systems are becoming compact in size and hence compact antennas with improved performance are required for these communication systems. Microstrip antennas may be proved very useful structures for these handsets, if their bandwidth performance improves. A conventional microstrip antenna has narrow bandwidth, low gain and operates at a single resonance frequency corresponding to its dominant mode. However, they are planar structures and are compact in size, light in weight, hence, they can be put inside the handset without protruding out [1][2][3]. Looking at these disadvantages, extensive efforts were made to improve their limitations [4][5]. Size reduction and bandwidth enhancement are becoming major challenges these days. In order to achieve the broadband performance of the microstrip antenna, some researchers have proposed variety of antenna structures, such as sector slots, notch or slits in patch etc. [6][7][8][9][10]. After achieving maximum bandwidth with infinite ground plane, the efforts are being made to modify the ground plane of these structures. With introduction of defected ground structure, depending on the shape and dimensions of the defect, performance of antennas is further improved [11]. These defected ground planes may also control electromagnetic waves propagating through the substrate layer.

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II. ANTENNA GEOMETRY

The antenna geometry has been shown in fig. 1. The antenna's substrate (S1) with dimensions of 105mm × 54.5mm is provided with a rectangular slot of size 61mm ×50mm and the
antenna's ground has the dimension of 64mm ×60mm which has been shown in fig. 2. The antenna has a slotted 'I' shaped radiating patch with three slots of equal dimensions of 75mm ×35mm. The substrate (S1) of the antenna's ground can be seen from the top view which has been shown in fig. 3.

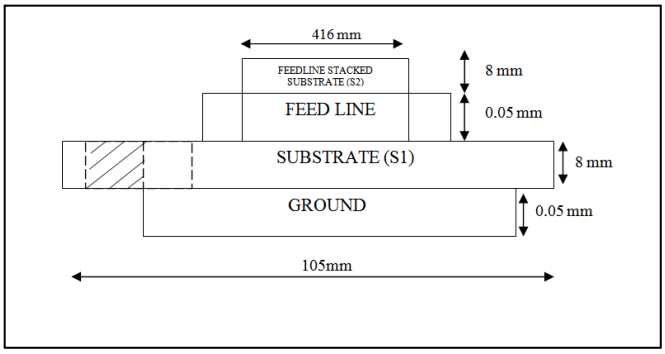

Fig. 1. Front view of antenna

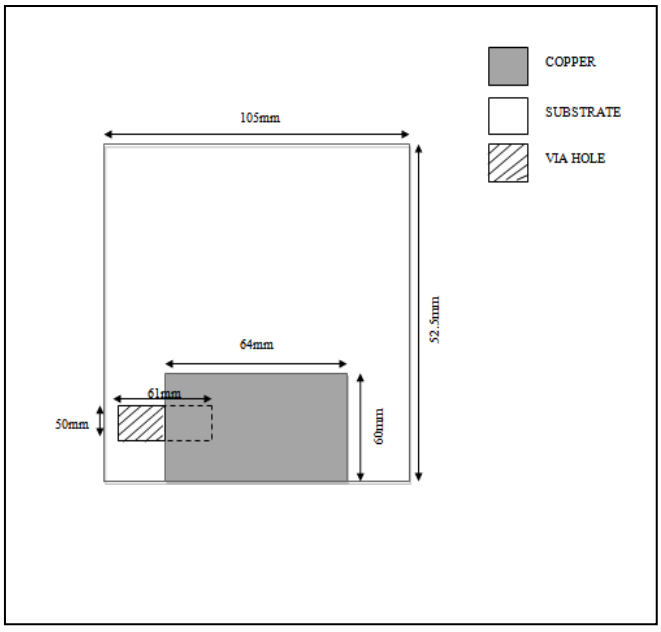

Fig. 2. Bottom view of antenna

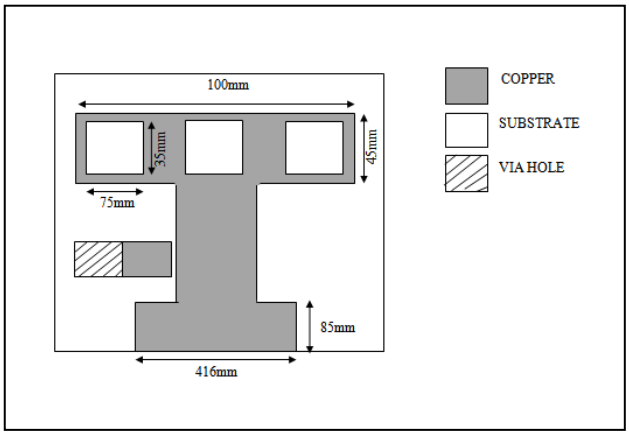

Fig. 3. Top view of antenna

III. RESULT

The proposed antenna has been designed and simulated using CST Microwave Studio 2014. The performance of proposed antenna has been analyzed in terms of return loss (dB), directivity (dBi), gain (dB), impedance bandwidth (GHz), VSWR and impedance (ohms). The return loss plot of the proposed antenna has been shown in fig. 4 which indicates that the antenna has the resonant frequencies of 2.4 GHz and 2.65 GHz and the bandwidth of 1.7128 GHz (1.2229 GHz to 2.9357 GHz). The gain and directivity of antenna is 2.97dB and 2.92dBi respectively at frequency of 2.4GHz which has been shown in fig. 5 and fig. 6. The gain and directivity of antenna is 4.01dB and 3.98 dBi at resonant frequency of 2.65 GHz. The VSWR plot of the proposed antenna design has been shown in fig. 7 which implies that the value of VSWR lies below the maximum acceptable value of 2. The Fig. 8 illustrates the Smith chart plot of the proposed antenna. It has been observed that the proposed antenna has impedance of 49.75Ω. The antenna can be employed for GSM 1800, GSM 1900, IMT, WLAN, Bluetooth and WiMAX applications.

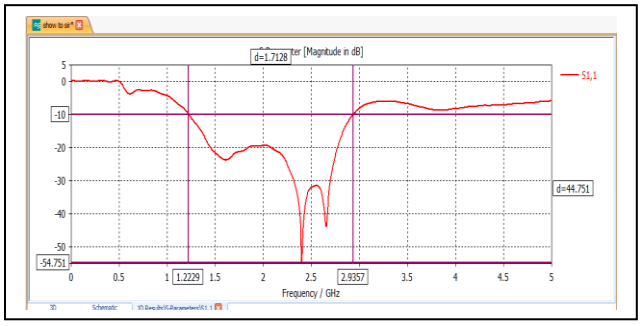

Fig. 4. Return loss plot of the antenna at 2.4GHz

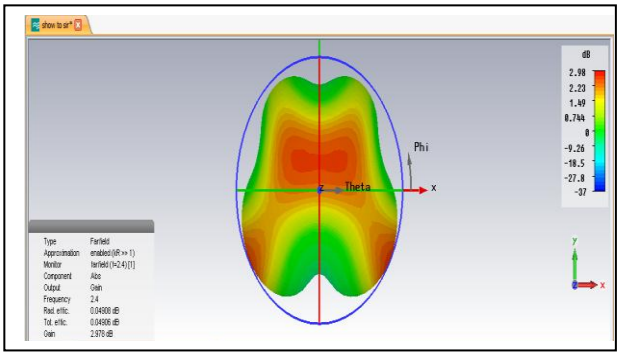

Fig. 5. Gain of the antenna at 2.4GHz

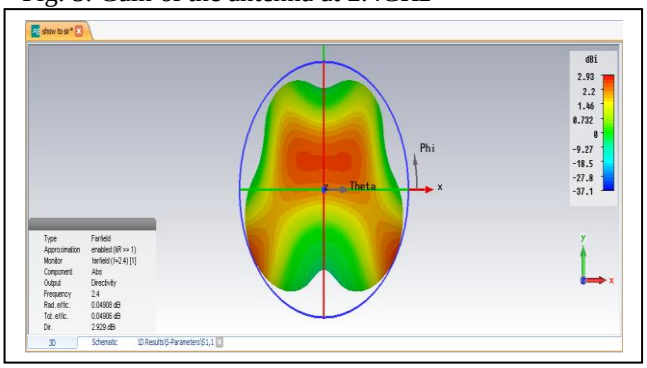

Fig. 6. Directivity of the antenna at 2.4GHz

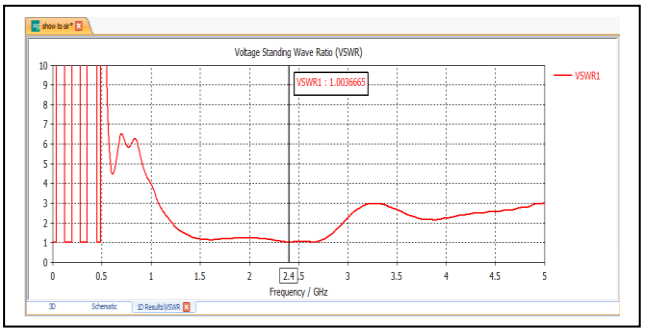

Fig. 7. VSWR plot of the antenna at 2.4GHz

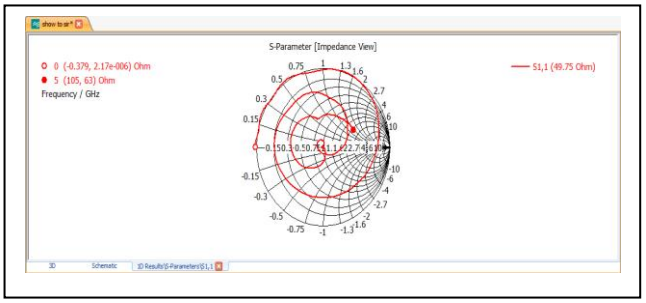

Fig. 8. Smith Chart plot of the antenna at 2.4GHz

IV. CONCLUSION

The proposed antenna has a return loss of -54.75 dB and -43.83dBi at resonant frequencies of 2.4 GHz and 2.65GHz respectively illustrating that the antenna is radiating at this frequency with minimal reflection losses. The antenna has the gain and directivity of 2.97 dB and 2.92 dBi at resonant frequency of 2.4 GHz respectively. The gain and directivity of 4.01dB and 3.98dBi at resonant frequency of 2.65GHz respectively. The antenna has impedance bandwidth of 1.7128 GHz with resonant frequencies of 2.4 GHz and 2.65GHz which makes its suitable employed for GSM 1800, GSM 1900, IMT, WLAN, Bluetooth and WiMAX applications.

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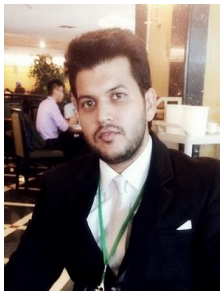

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