A Planar Inverted Feed Antenna for WiMAX and GPS Applications

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ABSTRACT—The mobile phone commerce is blossoming exponentially in the twenty first century. The novelty in Planar Inverted Feed Antenna (PIFA) has a massive position in it. It has a coaxial probe feed and numerous shorting pins in excess of the intended patch antenna. Flame Retardant (FR4) substrate is used in intending of antenna. The recompense in initiating the Defected Ground Structure (DGS) over the patch as well as Defected Microstrip Structure (DMS) was scripted in the intended antenna. The intended petite outline, worth effective and the antenna can be used in the functions similar to Global Positioning System (GPS) at 1.49 GHz reverberating frequency, Worldwide Interoperability for Microwave Access (WiMAX) at 2.53 GHz and 3.5 GHz reverberating frequencies respectively. Simulation is prepared through High Frequency Structural Simulator (HFSS).

Keywords- Defected Ground Structure (DGS), PIFA, Defected Microstrip Structure (DMS), Rectangular Patch, GPS, WLAN, WiMAX.

I. INTRODUCTION

Mobile communiqué manufacturing is flourishing exponentially day by day as the prerequisite for the mobile phones is on the ascend [1]. As the dimension of the handheld diplomacy used in mobile communiqué is plummeting radically, deceitful an antenna that hysteresis the dimension of mobile forms a most important factor of investigate in mobile commerce [2]. PIFA configurations are subdued in the antennas to create them supplementary feasible for the mobile communiqué [3].

GPS mechanism is essential in mobile communiqué as positioning the communiqué campaign are decisive throughout the communiqué progression [4]. Integrate the GPS with WiMAX third generation (3G) communiqué will decrease the dimension and prerequisite of detach strategy for mobile communiqué and GPS [5].

The Defected Ground Structure (DGS) over the patch as well as Defected Microstrip Structure (DMS) was scripted such that they are engraved in the position plane and are used to modify the essential reverberating frequencies as per the favored functions [6].

II. PROPOSED ANTENNA DESIGN

The intended antenna is a multiband PIFA antenna for GPS and WiMAX functions. Devious a rectangular patch antenna appearance the base of plan antenna that was intended based on the subsequent equations (1-6) [7]. Let the elevation of the substrate used for antenna intend be h, the width of the patch be W, the dielectric invariable of the substrate is εr then the effective dielectric invariable ε_eff is established by the subsequent equation.

\[
\varepsilon_{eff} = \frac{\varepsilon_r + \frac{1}{2} \left(1 + \frac{12}{\varepsilon_r} \right)^{\frac{1}{2}}}{\frac{1}{2} (\varepsilon_r - 1) + 1}.
\]

The effectual length of the patch is indicated by \( L_e \) and can be established by the subsequent equation

\[ L_e = L + 2\Delta L \]

whereas, \( \Delta L \) significance can be establish from the accommodating equation.

\[ \Delta L = 0.412 \left( \frac{f_0 - 0.3}{f_0 + 0.3} \right) \left( \frac{W}{h} \right)^{0.5} \left( \frac{W}{h} \right)^{0.5} \]

The reverberation frequency \( f_0 \) for any TM_mnmode where m and n are the modes of the rectangular patch antenna can be established by the alternate that is identified by the values of the subsequent equation.

\[ f_0 = \frac{c}{2\sqrt{\varepsilon_{eff}}} \left( \frac{m}{L} \right)^2 + \left( \frac{n}{W} \right)^2 \]

The intended width (W) of the antenna can be dogged with the next equation.

\[ W = \frac{c}{2f_0 \sqrt{\varepsilon_{eff}}} \]

The effectual length of the rectangular patch antenna \( L_e \) for a reverberation frequency \( f_0 \) is establish by the subsequent equation

\[ L_e = \frac{c}{2f_0 \sqrt{\varepsilon_{eff}}} \]

The recommended antenna plan is equipped over an FR4 substrate and the antenna is wound up by means of a coaxial feed. PIFA configurations are prepared in the antenna by commence two shorting pins that incite the multiband possessions in the intended antenna. Annular loop configuration is formed in the patch and ground plane for the favored function. The intended antenna has front scrutiny as exposed in Fig. 1, which demonstrates annular loop configuration embossed in patch region. The intended antenna has bottom scrutiny as exposed in Fig. 2, which demonstrates the annular loop configuration imprinted in ground plane region.
The recommended antenna was deliberate and replicated using HFSS platform. The intended return loss of the antenna is plotted in Fig. 3. The VSWR scheme of intended antenna is exposed in Fig. 4. The intended antenna has a return loss value of \(-29.4556\) dB for the reverberating frequency significant of 1.49 GHz which is suitable for the GPS function, \(-22.1634\) dB return loss value for the 2.53 GHz reverberating frequency in count to \(-21.9052\) dB return loss significant for the reverberating frequency 3.5 GHz that is suitable for WiMAX mobile communiqué standard. The emission prototype of the intended antenna at 1.49 GHz, 2.53 GHz and 3.5 GHz are exposed in Fig. 5, Fig. 6 as well as Fig. 7.
The reverberating frequency at 1.49 GHz has 0.17 dB gain, 2.53 GHz has a gain of 1.53 dB and 3.5 GHz has a gain of 2.2 dB. The emission prototype is directional prototype for the exact function.

IV. CONCLUSION

A multiband PIFA structured antenna for GPS communication and WiMAX functions are intended by initiated PIFA structures and annular loop structures in the predesigned rectangular patch antenna. The planned antenna can be activated at the preferred applications and is authenticated through the return loss and VSWR plots.

REFERENCES