DESIGN OF CIRCULARLY POLARISED PATCH ANTENNA FOR WLAN APPLICATIONS

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Abstract - The design of a low-profile omnidirectional circularly polarized (cp) patch antenna is proposed. To attain the wideband impedance matching condition, this antenna uses two monopolar modes of the circular patch which is connected to a modified ground plane by means of conductive vias. The edge of the circular ground plane consists of curved branches, which are used for creating circularly polarized fields through the excitation of a degenerate mode. This antenna operates at the frequency of 2.4 GHz which is used for WLAN applications. This antenna has a low profile of 0.024λ. The significant features of this antenna are, it attains 19.8% of 10-dB of impedance bandwidth and 19.3% of 3-dB axial ratio bandwidth. Finally, the antenna parameters such as reflection co-efficient, radiation pattern, axial ratio are measured the geometry of this antenna is drawn using HFSS. The entire design is coded using MATLAB. Then comparison is done.

Index Terms - circular polarization, low-profile antenna, omnidirectional antenna, wideband antenna.

I. INTRODUCTION

The use of circularly polarized (CP) antennas can enhance the signal reception in modern mobile communication systems. Omni-directional radiation patterns are desirable for some applications by reducing the number of cell sectors. A considerable number of designs have been studied recently for Omni-directional CP antennas. A patch antenna can produce vertically polarized wave while the arms around the patch produce horizontally polarized wave. When patch and arms are excited orthogonally, a CP wave can be excited. However, patch antennas usually have a narrow bandwidth. Antenna has a property known as reciprocity, which reveals an antenna will maintain the same characteristics regardless of transmitting or receiving. Currently highly directive antennas are mostly employed in the market. The gain of these antennas is between the ranges 8dBi to 20dB.

In the rapid growth of wide band communication system the circularly polarized patch antenna has unbeatable place. The omnidirectional circular patch provide large signal coverage and stability for the signal transmission. It provides immunity to multipath distortions and polarization mismatch losses. Initially, a broadband circularly polarized (CP) antenna was developed with an omnidirectional radiation pattern in the horizontal plane. Four broadband CP rectangular loop elements were employed for broadband omnidirectional CP radiation. This topology led to a poor omnidirectivity and a narrow.
bandwidth. Then, the study has been done to enhance the bandwidth of Patch Antenna for UWB applications. However, microstrip antennas inherently have a narrow bandwidth, and bandwidth enhancement is usually demanded for practical applications, so bandwidth enhancements are becoming major design considerations for practical applications of microstrip antennas. This printed wide rotated antenna is fed by a 50-Ω microstrip line with a rotated square wide parasitic patch for bandwidth enhancement. The potential of UWB technology is enormous due to its tremendous advantages such as the capability to provide extremely fast data rates at short transmission distances while requiring low power dissipation. But this biconical antenna has a big size which limits its application.

Then an antenna with isolated triangle gaps and crossed gaps etched on the metal patch and ground plane was demonstrated respectively. By changing the pattern on the ground, the impedance matching characteristics of the antenna are tuned much better. The -10dB impedance bandwidth of the proposed antenna is 3.85–15.62 GHz, which is about 27% broader. The width of the microstrip feed line is fixed at 2.40 mm to achieve 50-Ω. These requirements are extremely difficult or physically impossible to achieve. Then an omnidirectional circularly polarized (CP) antenna using a circular mushroom structure with curved branches was proposed. This antenna was based on the zeroth-order resonance (ZOR) mode of epsilon-negative (ENG) transmission line (TL) to obtain a vertical polarization and an omnidirectional radiation pattern. Also, the horizontal polarization is obtained by the curved branches. The phase difference between two orthogonal polarizations is inherently provided by the zeroth-order resonator. The major demerit is the larger ground plane which resulted in a poor axial ratio, also it needs two orthogonal components to generate CP fields.

Again an analysis is performed for a two-arm round spiral structure excited in phase, where the arms near the antenna center are backed by a small round disc. This spiral antenna has a frequency range where the radiation is bidirectional, having patterns symmetric with respect to the antenna plane. In this design VSWR shows a good value of less than 2 within the design frequency range. But the demerit is that the absorption of the currents at the arm ends increases, resulting in decrease in the radiation efficiency. Higher value of dielectric constant must be used which are less results in narrow bandwidth. Hence conciliation must be reached between antenna dimensions and antenna performance.

The circularly polarized antenna which can be easily implemented by properly slice a section (L) from a side of the equilateral-pentagon patch in which the fundamental resonant mode of the equilateral-pentagon antenna and it is split into two near-degenerate orthogonal modes with equal amplitudes and a 90° phase difference.

Similarly various designs such as arrays consisting of loop elements, monopole elements or dielectric elements have also been proposed to provide omnidirectional CP waves. These antennas exhibit wider bandwidth. However, all above antennas have relatively high profiles, which is not suitable for space-constrained applications. High profile antennas are also not conformal to carriers and may encounter large wind resistance. To reduce the antenna height, the designs based on patch have been investigated. Then, a broadband monopolar patch antenna with a low profile has been proposed. This antenna constitutes a circular patch, a circular ground plane, and a set of conductive vias which connect the patch and
ground plane. By properly choosing the vias dimensions, an impedance bandwidth of 18% can be easily realized. This antenna has a high reflection coefficient. Sometimes, the shorting-vias moves away from the optimum position, so that the impedance match becomes poor. In order to overcome the disadvantages of the above mentioned designs, a novel wideband omnidirectional CP patch antenna is proposed for Wide Band Application (WLAN). The frequency of the proposed antenna is 2.4 GHz. This Antenna consists of a circular top patch, a modified circular ground plane, and N-shorting vias. The proposed antenna design has 10-dB impedance bandwidth of 19.8% and a 3-dB AR bandwidth of 19.3%. In this design, a modified ground plane with stretched curved divisions is used to obtain a novel low profile omnidirectional CP patch antenna. This capitalizes the impedance match and Axial ratio can be tuned discretely. This feature is highly desirable as it greatly shortens the design process. To illustrate the proposed CP patch antenna, a parametric study was passed out using HFSS.

The computational tools are based on the HFSS (Finite-element method) and the MATLAB programming environment. The designed antenna has low profile of complexity for WLAN (Wireless local area network). This antenna has modified Ground plane design which will give high bandwidth of the operating frequency. It has an enhanced polarization in Omnidirectional path. The curved branches are responsible for produced the circular polarization.

II.ANTENNA CONFIGURATION

In proposed system, the design of antenna for achieving the gain improvement and also the dual notch from the existing work is done. In this proposed system we introduce the combined elements method is introduced to achieve dual notch band frequency selective surface (FSS).

In the proposed design, a modified ground plane with extended curved branches is used to obtain a novel low profile omnidirectional CP patch antenna. Another outstanding advantage of the proposed antenna is that the perturbations (curved branches) that are responsible for the CP fields have insignificant effect on the input impedance, because they are introduced in the ground plane instead of the radiating element. This means the match and AR can be tuned separately. Such feature is highly desirable as it greatly.

The analysis and results of antenna and FSS are produced by using the Ansoft HFSS. The results show that antenna’s gain can be improved after the FSS is placed as the reflection plane. This is a new research area which have great prospect in the design of antenna combined with FSS. A novel wideband omnidirectional CP patch antenna is proposed for Wide Band Application (WLAN). The operating frequency of the proposed antenna is 2.4 GHz. The proposed antenna design has 10-dB impedance bandwidth of 19.8% and a 3-dB AR bandwidth of 19.3%. In this design, a modified ground plane with stretched curved divisions is used to obtain a novel low profile omnidirectional CP patch antenna. This capitalizes the match and AR can be tuned discretely. To illustrate the proposed CP patch antenna, a parametric study was passed out using HFSS. The
relative proportions of the branches become smaller, resulting in a higher AR regularity.

**Fig 3. block diagram**

### III. PARAMETRIC STUDY

The structure of the proposed circular slot antenna with circular ground plane. The antenna uses a 3.0 mm thick FR4 substrate with a permittivity ($\leq \varepsilon_r$) of 2.2 and dielectric loss (tan) of 0.001. The centre frequency ($f_0$) of operation is decided at of 2.0 GHz. This frequency is selected, so that the antenna can be applied to 2.4GHz WLAN. The circular slot made at the centre of the circular ground plane has a radius (R) of 48.3 mm and designed to be around of the centre frequency. Once the designing process is over, the validation process is done to obtain the frequency plot, the radiation pattern, and the return loss plots of the designed antenna. The simulated antenna gains of the patch antenna at different angles are obtained. Similarly by varying lengths, radii, width of patch, various results are obtained.

### IV. RESULTS
V. CONCLUSION

The use of a directional antenna allows the electromagnetic waves to be focus towards a specific section. This allows wireless connections at greater distance from the router than a traditional omnidirectional antenna. In addition, higher data rate can be achieved at greater distances. This antenna would be beneficial in both rural and urban environments. A wideband omnidirectional CP patch antenna has been investigated in this communication. Its basic structure is a circular patch, which is shorted to an irregular ground plane by a set of conductive vias. A parametric study of the CP patch antenna has also been completed to examine the effects of various design parameters. It has been found that the vias mainly influence the impedance match while the extended branches mainly affect the AR.

VI. FUTURE WORK

In future there is a plan to design the antenna which is used to cover both WLAN and WIMAX application band with compatible size. In this antenna frequency for WIMAX is 3.3 – 4.0 GHZ and Frequency for WLAN Application is 5.05 – 5.9 GHZ. In this operating band we get the return loss value as > -10 DB and VSWR as < 2. By changing the substrate and design we can achieve this frequency.
VI. REFERENCES


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