A Compact Circular Patch Antenna for Wireless Network Applications

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Abstract

The compact double-band circular microstrip patch (MPA) with the etched slot for WLAN architecture is designed. A double recurrence circular patch design along space opening slot sustained with a transmission model is intended to acquire double recurrence task. The designed antenna model comprises of circular patch and parasitic - slot resonator. The ground plane is arranged with a space opening resonator. By modifying structure parameters, the microstrip patch works at the upper band (5.2 GHz) and parasitic - opening works at bringing down band (2.4 GHz), the two resonators are emanating with two diverse radiation designs. Remembering the true objective to choose the execution of the designed model and the composed structure shows the arrival misfortune less than - 10 B and it is demonstrated with huge impedance coordinating, enhanced radiation example and great VSWR around 1 over the working groups. The investigated configuration is simulated and analyzed with HFSS. The suggested antenna model is reasonable for wireless LAN applications.

Keywords: Circular patch; parasitic slot; dual band operation; miniaturization; WLAN.

1. Introduction

With fast advancement in innovation, the modern technological world needs devices which can be utilized as a part of different frequency bands. Double band antenna assumes a fundamental part of wireless administration necessities and is utilized to conquer the request of double recurrence operation. Microstrip patch antennas [1]-[2] are generally used to perform different operations required by different wireless innovation systems. With the advancement in correspondence, little, good, double band, low profile, low-cost antennas are in demand. The Remote neighborhood architecture is utilized as a part of different specialized gadgets over a huge range. The different types MPAs such as circular, rectangular, squares and ring slot shapes [3]-[9] have been portrayed in literature. Circular and rectangular patch antennas are having appealing highlights over the square and ring space shapes. The most normally drew in microstrip receiving wire is circular patch [1] radio wire. The Patch receiving wire is the ability to have outflow assorted variety.

The double recurrence circular patch arrangement along space opening slot [10]-[12] is intended and designed for wireless communication systems that can support the dual-band WLAN [13] applications. The intended antenna consists of a circular patch and parasitic slot that is etched on a ground plane to achieve dual-band operation. The intended configuration includes circular patch (MPA) and parasitic slot resonator [4]. Dual-band is obtained by designing slots on a ground plane. Circular patch is used to get the desired band [16]. The implemented model comprises of circular patch with space opening arrangement, such as a parasitic slot model. These two portions are relentlessly coupled and oscillate at both the recurrences. Their radiation designs have distinctive execution for remote correspondence applications.

Over the most recent couple of generations, an improvement in remote neighborhood represented to primary essential significance with immense data also correspondence range. An importance for remote neighborhood equipment has reached out in an incredible way. Remote mediums for recurrences working carriers of the emphasis on condition prerequisite analyzed before sketching out another remote neighborhood arrangement [14]. A 2.45 GHz space is sans permit, due to this scheme the superlative remote neighborhood gadgets experience the conflict effects of equipment's which use a comparable recurrence range. An ISM space is pertinent by IEEE 802.11b constraint.5.2 GHz is engaged by IEEE 802.11a [15] constraint and that is more wonderful help in huge speed WLAN. The considered arrangement, keeping in mind the end goal to stay away from by means of openings, the microstrip line sustain MPA is suggested. It is the least complex strategy to invigorate MPAs. The arranged model has the transmission channel imprinted in a similar structure energizes a microstrip fix that could be set straightforwardly finished a transmission channel conversely close-by finished the periodic system [18]. The microstrip provided line has more adaptability and conservativeness than co hub encourages line. The acknowledgement of transmission structure is accessible to match and easy to compose. To assert the model, the proposed double band circular patch with slot opening is intended for wireless network applications (WLAN). It comprises of the secondary band (5.2 GHz) and primary band (2.4 GHz) frequencies of the double band reception apparatuses are basically sensible by the MPA and opening space separately. This model has the highlights of little in an estimate, clear outline also accomplish twofold recurrence task of various radiation designs[19-26].
2. Antenna configuration

A compact double-band circular microstrip patch resonator with composed space sustained by a microstrip line is characterized to realize the double recurrence range. The suggested model comprises two different types of resonators; it consists of the circular patch resonator and opening space slot. The recommended dual-band model, the circular patch antenna oscillates at 5.2 GHz (UNII) and slot [2] oscillates at 2.4 GHz (ISM) which is suitable for wireless local area network applications. The indicated transmitting resonators are firmly integrated together and reverberate at numerous recurrences. By developing the disseminating resonators’ point, an unyielding double frequency-tunable circular path can be implemented. The sustain line is set on the substrate at the midpoint. Figure 1 exhibits the suggested double recurrence alignment of a WLAN arrangement.

A described receiving wire has a minimized component and aggregate design is around 4 x 4 x 0.16 cm³ and the expected radio wire is made with a substrate of FR4 with a thickness and relative permittivity is 0.16 cm and 4.4 subsequently. The explored model is imprinted on the two sides, one side is a ground plane with opening space and another side is round fix. The fix receiving wire resonators can be managed by a few models. The circular patch has a radius R=14 mm as shown in Figure 1. The degree of the 50-Ω coordinating matching line has the range of $L_f=2.1$ cm and $W_f=0.3$ cm.

The analytical operating frequency for a circular patch component is examined [16] with resultant equation and analogous to 5.2 GHz which is applicable for wireless LAN applications.

\[
a \; = \; \frac{F}{\left[\frac{1}{2} \cdot \frac{F}{2} \left\{ \log \left( \frac{2F}{\pi h} \right) + 1.7726 \right\}\right]^{1/2}}
\]

Here,

\[
F \; = \; \frac{8.791 \times 10^9}{f_r \sqrt{\varepsilon_r}}
\]

\(a\) = circular microstrip patch radius
\(h\) = substrate height
\(\varepsilon_r\) = dielectric constant of substrate
\(f_r\) = resonant frequency

Despite that, another approach is being an opening space set in the ground plane is intended to acquire essential recurrence (ISM) range. An arrangement of opening space model is as illustrated in Figure 1 and it comprises various rectangular spaces of dimensions $L_1$, $L_2$, $L_3$ and $W_s=0.05$ cm, an outline of space opening in the ground plane with counterbalance separations $S_2$ and $S_3$. The lower range is accomplished by embracing an opening space. Likewise, the opening space estimation was seen to be effective in controlling the resounding recurrence of the opening space mode. In order to diminish trial cut-and-Endeavour setup cycles, a re-authorization programming HFSS is used for oversee manufacture.

The model for the lower empower opening space consolidates the three space openings incorporates different expansiveness and equivalent measurement $W_s=0.05$ cm in the purpose of Figure 1, an opening space on the ground plane design consideration is $S_2=26$ mm, $S_3=11$ mm, different rectangular slot lengths are $L_1=1.8$ cm, $L_2=L_3=5$ mm as exhibited in Figure 1. By calibrating the alignment specifications, a compact patch module and opening space elements are utilized at the essential range (5.21 GHz) and the secondary range (2.45 GHz) eventually.

\[\text{Fig. 1: Designed MPA with opening space element}\]
3. Simulated results and discussions

Figure 2 demonstrates the return loss characteristics of the intended circular patch resonator. The roundabout resonator and an opening space component reverberate with discretionary and essential band subsequently. It is represented -37 dB and -34 return misfortunes at 5.21 GHz and 2.45 GHz consequently. The opening space oscillates as a result of a round resonator and there are no oscillations without patch arrangement.

The intended configuration radiation characteristics are exhibited in figure 3. The prescribed design emanates the most outrageous towards the greatest bearing at 5.21 GHz and space resonator is transmitting the patterns in bidirectional at 2.45 GHz. The radiation examples of a radio wire give the data that depicts how the reception apparatus coordinates the vitality it transmits. HYPERLAN and ISM recurrences are reasonable for wireless communications. All reception apparatuses, if 100% proficient emanate similar energy vitality for balanced proposal power little respect to design shape. The designed model SWR is exhibited in Figure 4. It is depicted as the examination of the offence between the load and maintain line. For culminate case estimation of SWR is 1 and for good impedance coordinating. The VSWR of an investigated antenna is 1.1 at 2.4 GHz and 1.05 at 5.2 GHz. The VSWR demonstrate that how intently or productively a radio wire’s terminal info impedance is coordinated to the trademark impedance of the feed line.
4. Conclusion
A compact double-band circular microstrip patch resonator with an etched space sustained by a microstrip line is described to realize dual recurrence service. The recommended circular patch model with opening space arrangement is realized to retrieve the elementary (5.21 GHz) and secondary (2.45 GHz) bands. The intended structure attainable and architecture parameters are realized by using characteristic analogy. An antenna contour has been reproduced and it is watched that transmission capacity and return loss of 5.15%, 4.25% and -37 dB, -34 dB at the resonant frequencies of 5.21 GHz and 2.45 GHz correspondingly. The illustrated model takes a less volume, smaller size, basic shape and satisfactory operational data transfer capacity, with the end goal that it is appropriate for remote neighborhood applications.

References