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Quarter Radius Separated Bicircular Microstrip Patch

Physics

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ABSTRACT

Circular Microstrip patch antenna (CMSA) design is modified by adding another circular patch of same radius, but displaced along the diameter by a quarter radius. The patches are simulated using Finite Difference Time Domain (FDTD) technique, to calculate return loss from 0.01-80 GHz. In one design (design geometry 1), these patches are placed along the axis of the feed line, and in the other design (design geometry 2), they are placed perpendicular to the feed line. Geometry 2 retained the notch type behavior, while geometry 1 exhibited 30% enhancement in Bandwidth around the resonance frequency.

1. Introduction:

Microstrip Patch antenna (MSA) has a low profile and a broadside radiation pattern.However, it has narrow bandwidth, spanning (3-6%) of the central frequency, which is not enough for most of the wireless communication systems nowadays. To meet the increasing demand of integrating multiple wireless communication systems into a single and small device, multiband and wideband antenna are preferred to avoid using different antenna for different operations on separate frequencies. Reported efforts for enhancement of patch antenna bandwidth include the loading of rectangular Microstrip patch antenna with two square slots across its side surface, giving BW of bandwidth of 286 MHz [1], incorporating metamaterial structure for a bandwidth improvement of 20 MHz [2].CPW-fed technique gives four resonant frequencies and impedance BW, applicable for ISM Band, CCTV, Wireless Video Links and WLANs [3]. A corner truncated patch with a slot at the centre makes the same useful for UMTS, LTE, WiMAX, and WLAN [4]. Incorporation of inverted L- and T-shaped parasitic elements at radiating apertures of the Microstrip antenna is proposed to render it useful for LTE-TDD34, WLAN and WiMAX [5]. A fractal MSA[6] is reported to resonate at 5 different frequencies, with impedance BW over 400 MHz in all these frequencies.

In this paper, we are simulating a couple of modified Circular Microstrip patch antenna. Materials and methods are presented in the section 2 and results are presented in section3, while concluding remarks are given in section 4.

2. Methodology:

The simulation of a modified geometry of circular Microstrip antenna is presented. The original geometry of the circular patch antenna is modified by adding another circular patch of same radius, but displaced along the diameter by a quarter radius. The two geometry chosen for simulation are shown in figure1. The patch, feed line and the ground plane are modeled as PEC(Perfect Electric Conductor), while the 2.4mm thick substrate is chosen as RO4350. The FDTD scheme of Lee was implemented using a matlab code with openEMS[7], run in GNU Octave[8] to calculate Return Loss over a frequency range 0.01 GHz to 80GHz.

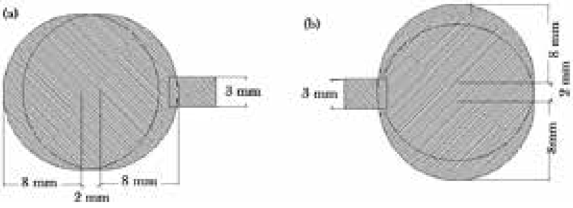


Figure 1: Modified design of circular Microstrip Patch antenna(a)Patch 1(b)Patch 2

3. Results:

The return loss S11 of the patch antennas are shown in figure 2 and 3. It is observed that patch 2 exhibited notch type behavior at 33 GHz, while, patch 1 displayed a BW of around 30% around the resonance frequency from 30GHz to 40GHz.Additionally, patch 1 exhibited some more resonances above 40GHz, up to 75GHz.

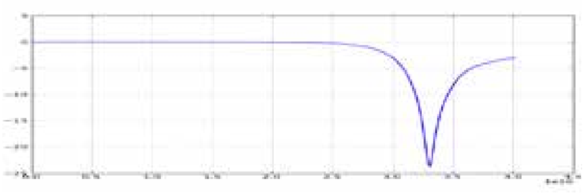
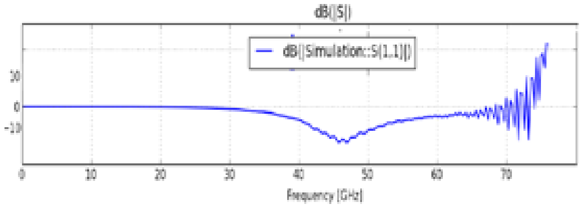


Figure 2: Return loss of patch 2



4. Conclusion:

In this work, a result of simulation of a couple of modified Circular Microstrip patch antenna are presented. The designs are simulated using OpenEMS in GNU Octave. Geometry 2 retained the notch type behavior at 33GHz, while geometry 1 exhibited 30% enhancement in Bandwidth around the resonance frequency. Such type of antenna is expected to fill the void in application of single planar antenna for wideband and multiband communication needs.

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