Back to Back Patch Antenna Operated Orthogonal Polarization for Repeater Use

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***Abstract*—A new back-to-back patch antenna with orthogonal polarization by proximity coupled feed is proposed for repeater use. Two rectangular patches are arranged relative to the ground plane. The proposed patch antennas have bi-directional radiation patterns with orthogonal polarized wave. Good input impedances, axial ratio, isolations and radiation patterns were obtained by simulation.**

Keywords—microstrip antenna, repeater

I. Introduction

The purpose of this paper is to propose new back-to-back rectangular or square patch antenna fed by proximity microstrip lines for orthogonal polarization, and clarify the characteristics of our proposed patch antenna by using electromagnetic simulation. The input impedance, axial ratio, isolation and radiation pattern are simulated.

II. Antenna Configuration

Fig.1 (a) shows the proposed new back-to-back patch antenna configurations with orthogonal circular polarization. The length and width of the rectangular patch are L2 and W2, respectively. The left side patch antenna radiates the right-hand circular polarization. The right side patch antenna radiates the left-hand circular polarization. Fig.1 (b) shows the proposed back-to-back square patch antenna configuration with orthogonal linear polarization. In this case, L4 is equal W2. The left side patch antenna radiates the vertical polarization. The right side patch antenna radiates the horizontal polarization. Fig.1(c) shows the top and side view of the proposed antenna. The both side patches are same configuration and each patch is formed on the substrate with dielectric constant εr=2.55, and thickness t=1.6 mm. The rectangular and square patches are arranged back-to-back, sandwiching the microstrip lines and the ground plane. The characteristic impedance of the proximity microstrip line of length L3, L5 and width W3 is 50 Ω. For orthogonal circular polarized antenna, the two microstrip lines are offset form the left side of the ground plane. [1],[2] And the offset length is 75 mm from the left side of the ground plane. For orthogonal linear polarized antenna, two microstrip lines are set at center of the patch.

III. Simulated Results

Fig.2 shows the simulated return loss, axial ratio of the circular polarized antenna shown in Fig.1 (a). The return loss more than 10 dB was obtained from 1.53 to 1.603 GHz when the ports #1 and #2 were fed. The axial ratio less than 2 dB was obtained from 1.549 to 1.551 GHz.

Fig.3 shows the return loss of linear polarized antenna shown in Fig.1 (b). The return loss more than 10 dB was obtained from 1.52 to 1.562 GHz when the port #3,#4 were fed.

Fig.4 shows the simulated circular and linear polarized radiation patterns at 1.55 GHz and 1.543 GHz in Y- Z plane. Good orthogonal polarized bi-directional radiation patterns were obtained. The gain of linear and circular polarized antenna was about 4.1 dBi.

Fig.5 shows the simulated isolations S21 of circular polarized antenna and S43 of linear polarized antenna. The 50 dB isolation was obtained from 1.4 to 1.8 GHz for both cases.

IV. Conclusion

We proposed back-to-back patch antenna by proximity coupled feed for orthogonal circular and linear polarization. The proposed patch antennas have bi-directional radiation patterns. Good input impedance, axial ratio, isolation and radiation pattern were obtained by simulation. So, the proposed antenna was useful of the repeater use for various mobile communication systems.

References

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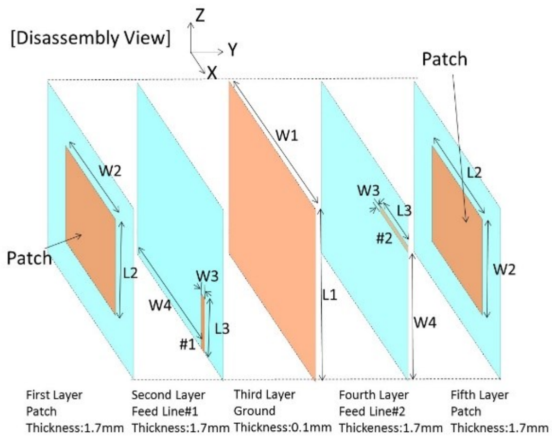
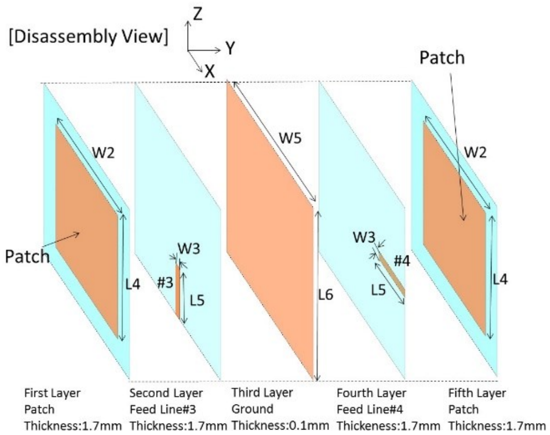
[2] H. Iwasaki, N.Chiba, “Circularly polarised back-to-back microstrip antenna with an omnidirectional pattern,” IEE Proc.-Microw. Antennas Propag., Vol.146, No.4, August, 1999.



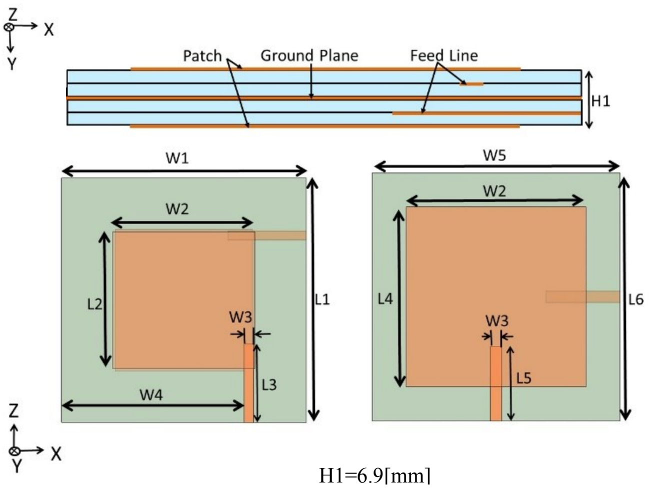
W1=100, W2=58, W3=3, W4=75, L1=100, L2=56, L3=32[mm]

(a) Circular polarized antenna.



W2=58, W3=3, W5=80, L4=58, L5=24, L6=80[mm]

(b) Linear polarized antenna.



H1=6.9[mm]

(c) Top and side view.

Fig. 1. Proposed patch antenna configuration.

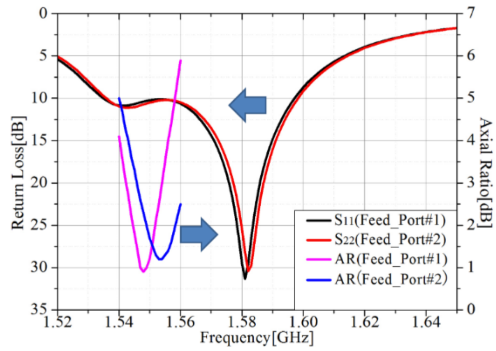


Fig. 2. Simulated return loss, axial ratio of circular polarized antenna shown in Fig.1 (a) and (c).

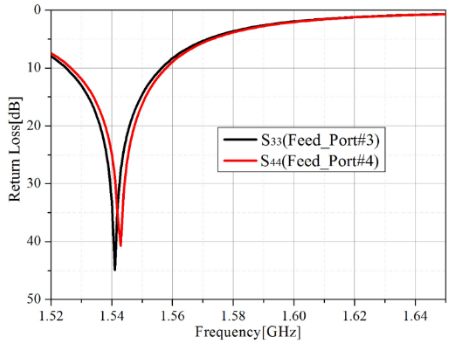
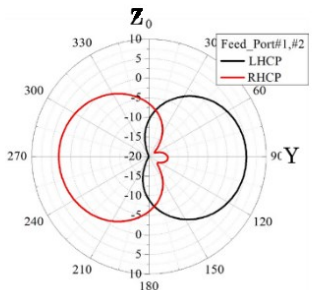
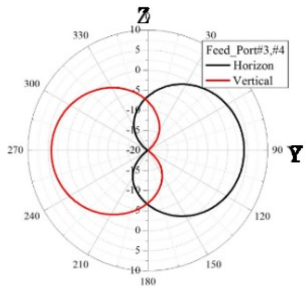


Fig. 3. Simulated return loss of linear polarized antenna shown in Fig.1 (b) and (c).



(a) Circular polarized antenna



(b) Linear polarized antenna

Fig. 4. Simulated radiation patterns of circular and linear polarized antenna at Y-Z plane.

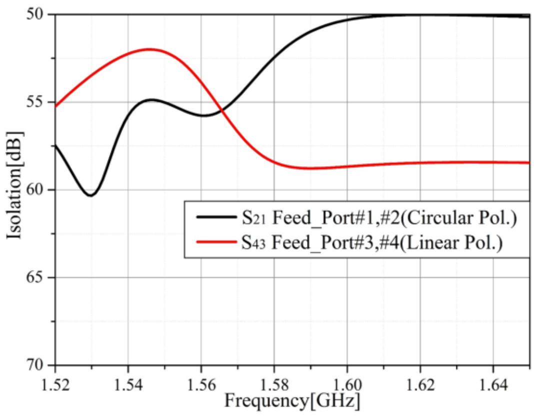


Fig. 5. Simulated isolations S21 of circular polarized antenna and S43 of linear polarized antenna.