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A STATE OF THE ART SURVEY ON WIDEBAND CIRCULARLY POLARIZED MICROSTRIP ANTENNA (CPMA)

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Abstract

This paper provides a description of the circularly polarized microstrip patch antenna (CPMA) and the use of circular polarization and cavity to enhance the basic characteristics of the antenna. The use of circularly polarized antennas is an efficient solution to achieve polarization matching between transmitting and receiving antennas. The use of cavities in this antenna helps to suppress surface waves and increase the antenna's bandwidth. To improve the desired level of performance parameters such as resonance frequency, gain, directivity, radiation efficiency, and antenna efficiency for the dual resonance, there are many techniques for designing circularly polarized microstrip antennas. Circularly polarized microstrip antennas, literature review, simulation tools, benefits and drawbacks over traditional microwave antennas and applications are listed in this letter. The comparative analysis of several circularly polarized methods of microstrip antenna design used by researchers is also discussed in this letter.

Keywords: *Antenna, Circularly Polarized Microstrip Patch Antenna (CPMA), Receiver, Transmitter.*

I. INTRODUCTION

Because of the limitations of wired communication, the receiver and transmitter are fixed at a specific location and the use of wires increases the complexity of the systems and makes the system bulky, the need for wireless communication was felt [1]. With the help of an antenna, wireless communication can be achieved easily. With the increasing use of wireless applications, low cost, light weight and miniature antennas are needed to make it easy to produce on a small chip [2]. The most suitable antenna is cavity backed circularly polarized microstrip patch antennas for the same purpose (CPMSAs) [3].

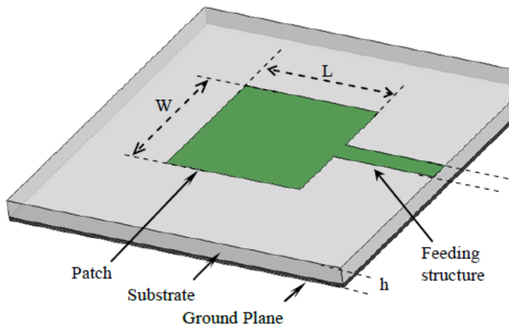

Fig. 1: Illustrates rectangular microstrip patch antenna [4].

The width W of the microstrip patch antenna is calculated by using the following equation.

$$w = \frac{c}{2\, f_r \sqrt{\frac{(\varepsilon_r + 1)}{2}}}$$

Where

f_r denotes the resonant frequency, and

r represents substrate dielectric constant

The effective dielectric constant (ε_{reff}) of antenna is derived by applying the given equations.

$$\varepsilon_{reff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2} \sqrt{\left(1 + 12\frac{h}{W}\right)}$$

Where h denotes the height of the antenna and W denotes the width.

The length of the antenna may be measured by applying the following equation.

$$L = \frac{c}{2\, f_r \sqrt{\varepsilon_{reff}}}$$

The antenna length extension is calculated by applying the equation below.

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$$\Delta L = 0.412\, h\, \frac{\left(\varepsilon_{reff} + 0.3\right)\left(\frac{W}{h} + 0.246\right)}{\left(\varepsilon_{reff} - 0.258\right)\left(\frac{W}{h} + 0.8\right)}$$

Here W represents the width and h denotes the height.

The real length (L_{eff}) of the antenna can be calculated by using the following formula.

$$L_{eff} = L + 2\Delta L$$

$$r_{x,y} = \frac{C(x,y)}{\sqrt{D(x)}.\sqrt{D(y)}}$$

Where $C(x,y), D(x)$ and $D(y)$ can be evaluated by using the following equations.

$$C(x,y) = \frac{\sum_{i=1}^{K}(x_i - E(x))(y_i - E(y))}{K}$$

$$D(x) = \frac{1}{K}\sum_{i=1}^{K}(x_i - E(x))^2$$

$$D(y) = \frac{1}{K}\sum_{i=1}^{K}(y_i - E(y))^2$$

II. LITERATURE REVIEW

For 60 GHZ wireless communications, Zhou performed a survey on a wideband circularly polarized patch antenna. The concept of a fully packaged 60 GHz wideband patch antenna containing an air cavity and a fused silica superstrate is discussed in this paper. By inserting a diagonal slot at the middle of the square patch, circular polarization (CP) is realized. A high efficiency (>90 percent) microstrip fed CP antenna is built with an impedance bandwidth of 24 percent and a 6 dB axial ratio bandwidth of 21.5 percent by optimizing the patch and slot dimensions. A coplanar waveguide (CPW) with λ/4-open-ended stubs for the microstrip transition is then built to fit the antenna to the CPW packaging interface. The final packed antenna's experimental results agree fairly with the simulation results, showing an impedance bandwidth of more than 26 percent and a bandwidth of 6 dB axial ratio of 22.7 percent [5].

III. DISCUSSION AND CONCLUSION

The objective of this review paper is to describe the wideband circularly polarized microstrip patch antenna and ways to improve its performance in order to enhance its applicability. Basically, the microstrip antenna's bandwidth is its main limitation. Through this review paper, we presented that circular polarization can be achieved by modifying the shape of the patch antenna or using different feeding techniques, which helps to increase the CPMA bandwidth. We also presented slotted CPMA differently and it is clearly shown that slot shape and size also helps to achieve increased bandwidth, improved efficiency and gain. The use of the cavity reduces surface waves, which improves the efficiency of the antenna. So we can achieve a better performance antenna by using the cavity-backed circularly polarized microstrip patch antenna.

IV. REFERENCES

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