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MICROSTRIP PATCH ANTENNA DESIGN AND FEEDING TECHNIQUES: A STATE OF THE ART SURVEY

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Abstract

In the past few decades, the study of antennas has taken a leap. Microstrip patch antennas have come to the picture in comparison to the conventional large size antennas and have found their use in cell phones, defence equipment, wireless wearable devices, etc. In contrast to conventional antennas, the Microstrip patch antenna has more benefits and produces better performance. Being smaller, foldable, simple to produce, multiple frequency operations, limited in size, in almost all wireless applications, Microstrip patch antennas have replaced almost all conventional antennas. A study of various Microstrip antennas with different feeding techniques and their application to conventional antennas is discussed in this paper.

Keywords: *Microstrip Antenna; Microstrip Patch Antennas; Slotted Microstrip Antennas; Transmitter.*

I. INTRODUCTION

The world of the antennas involves the understanding of the antennas' sense, function, parameter, and form. It is possible to describe an antenna as an electromechanical system capable of transmitting or receiving electromagnetic waves [1]. In other words, an antenna can be said to be a series of elevated conductors that pairs or matches free space with the transmitter or receiver. A transmitting antenna linked to a transmitter pushes electromagnetic waves to free space, and then travels at the speed of light in space. Likewise, a transmitting antenna attached to a radio receiver absorbs or intercepts a portion of space-based electromagnetic waves. Figure 1 shows the structure of a microstrip patch antenna [2].

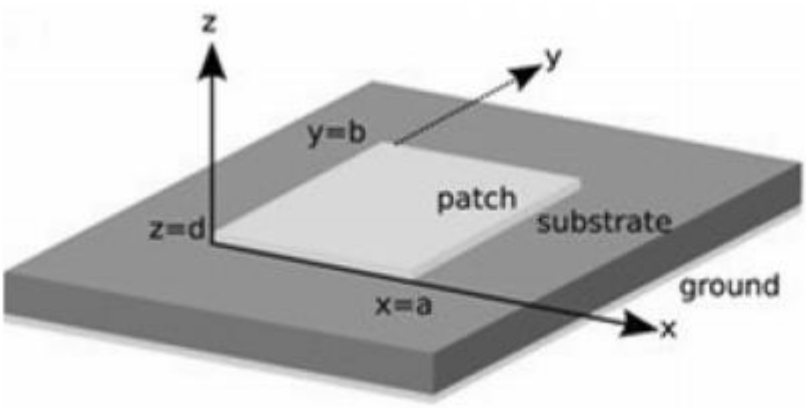

Fig. 1 Shows the Structure of a microstrip patch antenna

Microstrip Line Feed is the most basic feeding technique used. In this, a Microstrip line with impedance 50 Ohms is attached with the patch, and the port is connected at the other end of the additional Microstrip line introduced [4]. This additional Microstrip line acts as a feeding point to the rectangular Microstrip patch antennas. Figure 2 illustrates the rectangular patch with microstrip feed line [3].

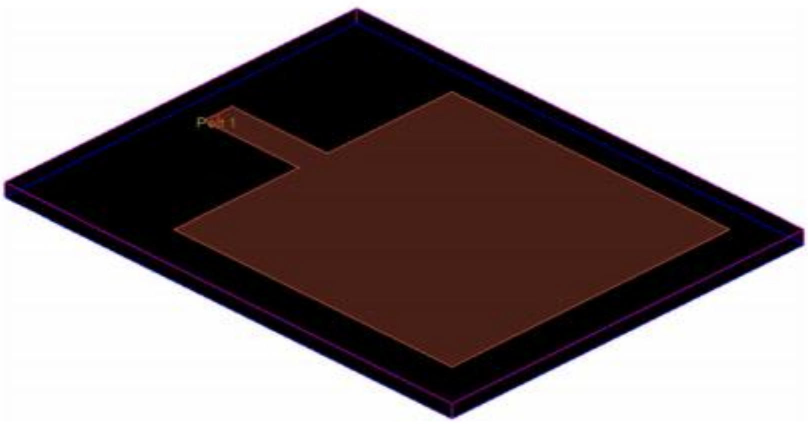

Fig. 2 Illustrates the rectangular patch with microstrip feed line

Microstrip Inset Feed is the advancement of the previously introduced Microstrip feed line. In this feeding technique, a feed point is measured somewhere on the surface of the rectangular patch where the impedance of the patch matches with the impedance of Microstrip feed line that is 50 ohms. Figure 3 illustrates the Microstrip inset fed patch antenna design [4].

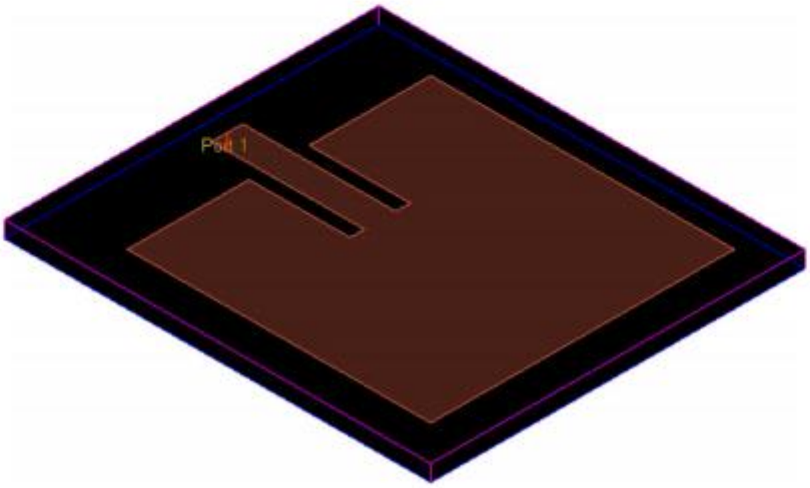

Fig. 3 Illustrates the Microstrip inset fed patch antenna design

The width W of the DRA antenna can be determined by utilizing 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 DRA antenna is derived by using the following 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.

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

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.

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

II. LITERATURE REVIEW

A research by Kumar et al was conducted on the circularly polarised microstrip patch antenna. For mobile communication and GPS applications, a triple-frequency single-feed S-shaped circularly polarised microstrip antenna with a minimal frequency ratio has been proposed. In the centre of a square patch of 84.5 to 84.5 mm2 for multi-band service, an S-shaped slot is eliminated. The suggested antenna geometry consists of a single microstrip line with an aperture-coupled feeding structure. The simulation results show that the proposed antenna can be used with an acceptable return loss of -34.34 dB, -18.23 dB and -24.75 dB for multiband antennas at 1.193 GHz, 1.454 GHz and 1.615 GHz, respectively [5].

III. DISCUSSION AND CONCLUSION

We can see that the signal magnitude at 2.45 GHz is much higher for coaxial feed compared to the four feeding methodologies (including direct feed at the edge of the patch antenna). A comparative performance for the inset feed can also be seen. However, at 2.45 GHz, the direct feed or Microstrip patch feed does not provide an apt response. This clearly means that the quality of coaxial feed compared to the other feeding techniques is much higher. In addition, the use of the array antenna improves the performance more than any other feeding process. The antenna presented in the array uses inset feed for all antennas. Using the coaxial fed will further enhance the outcomes, leading to a better antenna design, it can be deduced. Furthermore, the MSA is still considered to be underdeveloped, although conventional antennas have already been replaced in the application.

IV. REFERENCES

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