Chapter 13
Relationship Between Co-Axial Probe Feed and Inset Feed in Rectangular Microstrip Patch

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ABSTRACT

In this chapter, an equation is obtained using curve fit formula that shows the relationship between the simulated co-axial probe feed distance and theoretically inset feed distance in rectangular microstrip patch antenna. The simulation process is performed using IE3D simulation software tool and theoretical calculation performed by the cavity model. Using this equation, one can avoid hit and trial for getting simulated co-axial feed distance by knowing theoretically inset feed distance. A ratio also has been developed between co-axial probe feed and inset probe feed.

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INTRODUCTION

Modern communication system widely used microstrip patch antenna because of its lightweight, compact and cost effective constraints. In the design of patch antenna, the feeding method plays a significant role. The input impedance of patch antenna depends on the feeding type and theirposition. By varying the feed position an analysis of the impedance variation has been performed in microstrip line fed patch antenna. For this substrate's size and finite metallization thickness with various lengths of the feeding line as well as losses are taking accounts (Snezana et. al, 2014). The contacting scheme such as co-axial probe feed and microstrip line, have RF power directly to the radiating patch and electromagnetic field coupling has been used by other contacting scheme such as proximity and aperture coupled feed, for the transferring power between the microstrip line and radiating patch (Varshney et. al, 2014). Microstrip patch antenna has so many methods for the analysis, in which cavity, transmission line and full wave methods are more popular methods. Based on transmission line method a microstrip patch antenna has been designed for 2.45 GHz (Barrou et. al, n.d.).

A transmission line model has been used for analysis and a curve fit formula has been presented for locating the exact inset feed to obtained 50Ω input impedance with microstrip line inset feed (Ramesh and Yip, 2003). Full wave analysis, transmission line and cavity model has been used for analytical study of input impedance behavior of co-axial probe feed patch antenna (Pozar, 1982 & Garg, Bhartia, and Ittipiboon, 2001). The input impedance of co-axial probe feed and inset feed patch antenna exhibit $\cos^2(\pi Y_0/L)$ and $\cos^4(\pi Y_0/L)$ behavior respectively with Y_0 is the feed point position from the radiating edge along the direction of length (L) (Basilio et. al, 2001).

A theoretical investigation has been performed which shows that the input impedance dependent on feed position of rectangular patch antenna (Ghatak and Pal, 2015 & Samaras, Stefanovski, and Branko, 2014). The input impedance can be adjusted by varying the feed point location. To obtain a good matching between the generated impedance and input impedance, it has been required to determination of exact feed point.

In this work, an exact inset feed distance is determined using model expansion analysis method for good impedance matching and verified by simulation process. In addition, the coaxial probe feed distance is determined by simulation process and theoretically verified using cavity model analysis method. A relationship is developed between the theoretical inset feed distance