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# Compare Proximity Feeding Technique with Probe Feeding for Simple Rectangular Microstrip Antenna

Madhuri B. Deokate
E&TC Department
VPCOE Baramati
Baramati, India

S. B. Deosarkar
E&TC Department
VPCOE Baramati
Baramati, India

***Abstract*- A micro strip patch antenna consists of a dielectric substrate, with a ground plane on the other side. The Micro strip antenna has advantages such as low cost, light weight and portability. To overcome its main disadvantage of narrow bandwidth, there are various techniques for increasing the bandwidth BW of (MSA)'s. The main techniques used to increase the bandwidths is to cut slots of different shapes – such as a U-shaped slot, a V-shaped slot, an L-shaped slot, or a pair of rectangular or toothbrush shaped slots – at an appropriate position inside the patch. This project aims compare the feeding techniques for simple rectangular patch.**

**In this project, bandwidth increases by using proximity feeding technique compare to probe feeding technique for simple rectangular microstrip patch antenna. Simulation process is carried out by using HFSS software.**

**Index Terms-** ***Rectangular Micro strip Antenna, Proximity feed.***



## I. INTRODUCTION

There is an extensive research on micro strip antennas which exploiting their disadvantage such as narrow bandwidth which can limit their use in some modern wireless applications.[1] So there is an increasing demand for low-profile, easy to manufacture, and multiband/wideband antennas which can be easily integrated within communication systems.

A micro strip antenna has several advantages such as low weight, low profile planar configuration, low fabrication costs and capability to integrate with microwave integrated circuit technology, the micro strip antenna is very well suited for application such as wireless communication system, cellular phones, pagers, radar system, and satellite communication system. Narrow bandwidth in micro strip patch antenna is a disadvantage. To increase the bandwidth of micro strip antenna by increasing patch height over ground plane, using a lower substrate permittivity, multilayer structure consisting of several parasitic radiating elements with different size resulting in a thicker antenna structure, printed antennas in different shapes. Recent trends have seen the development of broadband antennas, multi-band antennas or reconfigurable antennas receiving much attention to fulfils different applications in just one single terminal. Single terminals or devices could have many applications such as, GPS, GSM, WLAN, Bluetooth, etc. To suit such applications Wideband, multi-band or reconfigurable antennas have been developed.

A variety of studies have come up with different techniques to achieve broadband operation for printed antennas. Some of the techniques employed are changing the physical size of the antenna, modifying the radiator shape to allow current paths to travel at longer distances (which sometime increases the antenna size), and adding additional parts such as multi layers or gaps which again makes the antenna larger and of a higher profile.

## II. OVERVIEW OF MICROSTRIP PATCH ANTENNA

An MSA in simplest form consist of a radiating patch on one side of a dielectric substrate and ground plane on other side. The MSA has proved to be an excellent radiator for many applications because of its several advantages such as low weight, low volume, low cost, conformal configuration, compatibility with integrated circuits and so on. But it also has several disadvantages such as Narrow bandwidth, Lower gain, and Low power-handling capability. Increasing the BW of MSAs has been the major thrust of research in this field. [1]

The rectangular and circular patches are the basic and most commonly used micro strip antennas. Rectangular geometries are separable in nature and their analysis is also simple. The enhancement of the bandwidth and the achievement of multi frequency operation are major challenges for the antenna designer and many techniques have been proposed for this purpose. There are several ways to achieve broad band such as slots, suspended ground, changing feeding techniques, by changing radiator shapes which are explained in literature.

## III. LITERATURE REVIEW

Kin-Lu Wong and Wen Hsu, " A Broad-band Rectangular Patch Antenna with pair of Wide Slits ", in which design of a probe-fed rectangular patch antenna with pair of slits with an air substrate due to this good impendence match over bandwidth.

S.K.Sharma, L.Shafai proposed, " Performance of a Novel Ψ-shape micro strip patch Antenna with wide Bandwidth ", micro strip Antenna suffer from narrow impedance BW ,which can improved by employing coupled resonator structures such as stacked MA.

A. A. Deshmukh, K. P. Ray proposed, "Compact Broadband Slotted Rectangular Micro strip Antenna", in this both half –U-slot cut RMSA and rectangular slot cut RMSA combined together in same patch due to two resonant slotted antenna gives more bandwidth as comred to only a rectangular slot cut or half-U-slot-cut rectangular micro strip antenna. Antenna has broadside radiation pattern over the entire bandwidth.

Ricky Chair, K.F.Lee, C.Mak proposed, "Miniature Wide-Band Half U-Slot and Half E-Shaped patch Antennas ", in this shorting Pin(reduce size of patch) technique is applied to half U-slot and half E-shaped patch antenna, due to resonant slots the antenna gives more bandwidth as compared to only a rectangular-full-cut or Full-E-cut rectangular micro strip antenna. Impedance BW, Gain, Radiation pattern, efficiency is same as Full U slot antenna.

A. A. Deshmukh, K. P. Ray proposed, "Broadband proximity fed modified Rectangular Micro strip Antennas", with use Proximity feeding technique and thicker substrate which increase the bandwidth.

Yikai Chen, S. Yang, Zaiping Nie proposed, "Bandwidth Enhancement Method for Low profile E-Shaped Microstrip Patch Antennas ", by introducing distributed LC circuit to E-shaped antenna which increase the bandwidth.

## IV. PROCEDURE FOR ANTENNA DESIGN

### *A. Design Equations*

The geometry for rectangular shaped Micro strip Antenna is shown in Figure.1. Design rectangular patches antenna. Rectangular patch with dimensions (L * W) is separated from ground plane with a FR4 substrate (ε =4.4) of thickness h=1.56 mm.

### *B. Design Parameters and simulation*

A substrate of thickness 1.56mm, width and length of the patch as 38mm and 29mm respectively were considered based on the design dimensions. The operating frequency of the proposed antenna is 2.4GHz. In this work, co-axial or probe feed technique is used as its main advantage is that, the feed can be placed at any place in the patch to match its input impedance (usually 50ohms). The patch for three different design with a single coaxial feed was resonating from 2.3GHz to 2.6 GHz with moderate return loss; HFSS software is used to model antenna and plot return loss, VSWR, Directivity, bandwidth.

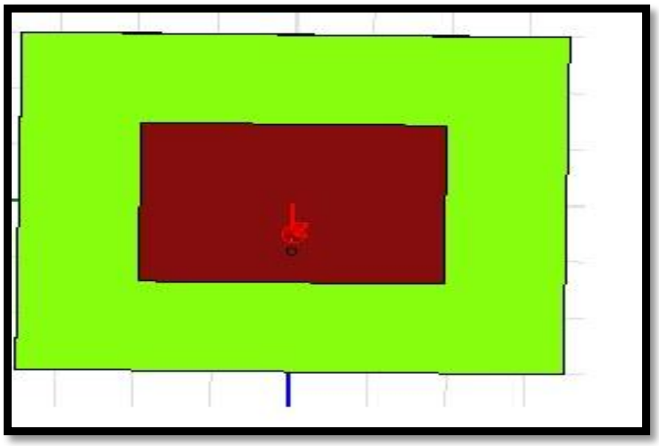
### *C. Feed Point Location*

A coaxial probe type feed is used in this design. The center of the patch is taken as the origin and the feed point location is given by the co-ordinates (X, Y) from the origin. The feed point must be located at that point on the patch, where the input impedance is 50 ohms for the resonant frequency. A trial and error method is used to locate the feed point. The return loss is compared for different locations of the feed point and the feed point is selected where the return loss is most negative and impedance match of 50 ohms is obtained.

## V. RESULTS OBTAINED

### *A. Rectangular Patch Antenna using Probe Feed*

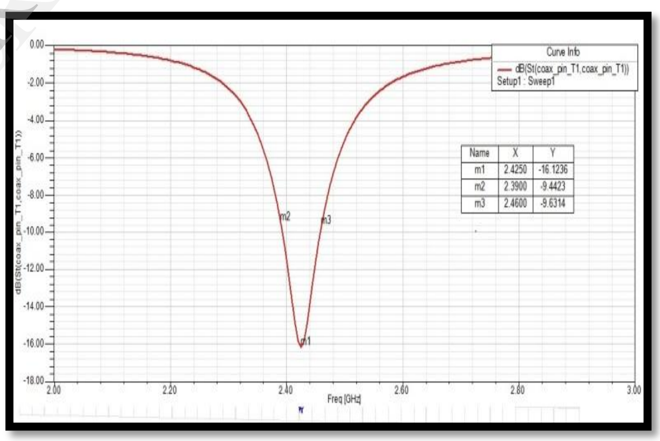
The rectangular micro strip patch antenna designed on HFSS



simulator software shown in below Figure.1.

Figure 1: Rectangular patch antenna with probe feed.

We have design operating frequency for antenna as 2.4GHz, but after simulation resonance frequency shifted at 2.39GHz to 2.46GHz, with return loss *of 16dB.* Return loss is a parameter which indicates the amount of power that is "lost" to the load and does not return as a reflection. Hence the return loss is a transmitter and antenna has taken place, indicated as S11 of a parameter to indicate how well the




matching between the antenna. For optimum working return loss graph must show a dip at the operating frequency and

Figure 2: Return Loss versus frequency graph

have a minimum dB value at this frequency. Figure.2. show the return loss versus frequency graph. It shows -23 dB return loss at 2.23 GHz frequency. It indicates that all power transfer from generator to antenna without loss. Perfect Load would have infinite return loss meaning that no power would be returned to the source. Return loss is related to standing wave ratio (SWR) and reflection coefficient.

The one more antenna parameter is its radiation pattern, which is a graphical representation of radiated power. This plot allows us to visualize where antenna transmits and receives power. Figure.3. shows the radiation pattern of antenna at 2.23GHz.This pattern was directional. It shows the vertical polarization. There present the back lobe for opposite side which indicate the loss of power in that direction.

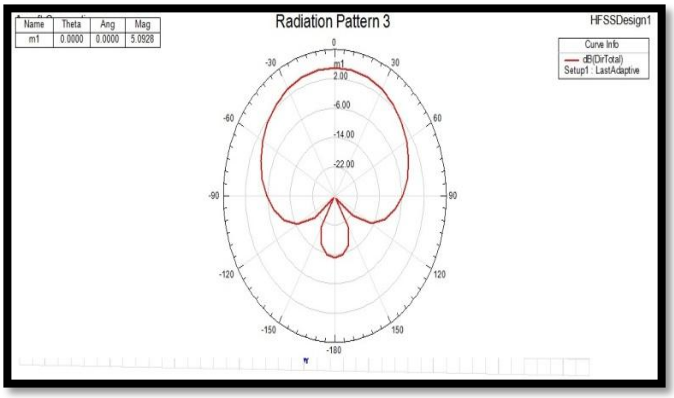



Figure 3: Radiation Pattern of Rectangular Patch Antenna.

*B .Rectangular Patch Antenna using Proximity feed*

By changing the feeding technique i.e. proximity feed in that microstrip line is placed in between substrate and ground which are separated by two dielectric substrate. Height of patch increases from ground plane by using this technique.

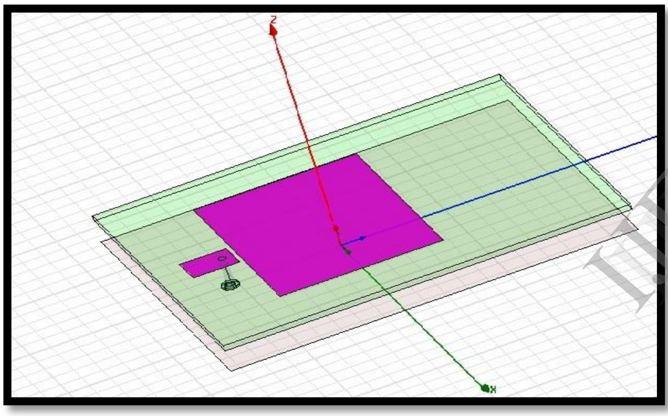


Figure 4: Rectangular patch antenna with proximity feed.

Figure. 4. Shows the rectangular micro strip antenna using proximity feed. This is an indirect feed method. In that there is no direct contact between patch and microstrip line. Patch electromagnetically coupled with microstrip line. Return loss for this geometry -15 dB at 2.41GHz shown in Figure.5. It indicates that perfect impendence matching between antenna and transmission line.

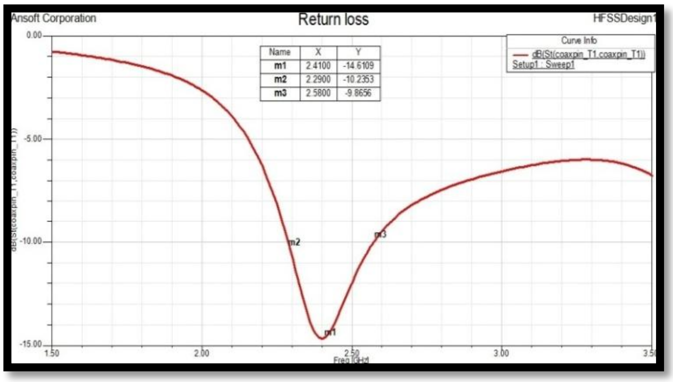



Figure 5: Return loss Vs Frequency Graph.

For rectangular microstrip antenna using proximity feed shows the directional radiation pattern with small back lobe in Figure.6. It indicates small amount of power loses takes place in opposite direction.

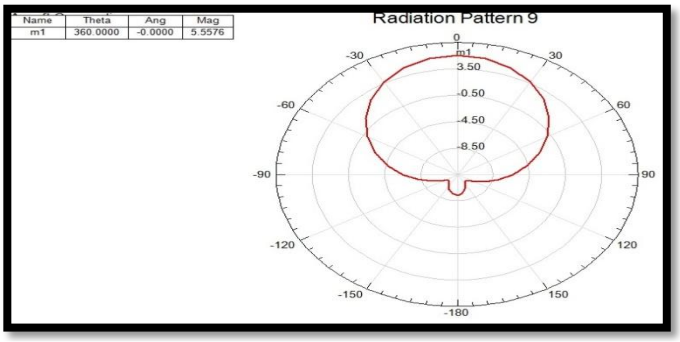



Figure 6: Radiation Pattern of Rectangular Patch Antenna.

TABLE 1. Shows Comparison of MSA.

| Sr. No | Shape of Antenna | Frequency (GHZ) | VSWR | BW (MHz) | Directivity (dB) |
|---|---|---|---|---|---|
| **1.** | Rectangular MSA using probe feeding | 2.39-2.46 | 1.38 | 70 | 5.0 |
| **2.** | Rectangular MSA using proximity feeding | 2.29-2.58 | 1.45 | 290 | 5.64 |



## VI. CONCLUSION

Simple rectangular microstrip antenna using proximity feed technique gives 290 MHz bandwidth than another probe feed technique. In proximity feed height of patch from ground plane increase it gives more bandwidth compare to other feed technique. This antenna is useful for Bluetooth application.

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