Triangular Microstrip Patch Antenna: A Literature Review

Mayurakshi Roy Medhi

Abstract— In this paper, some previous applied techniques to improve the parameter such as return loss, gain, bandwidth, VSWR of triangular microstrip patch antenna described by different researchers are discussed.

***Index Terms*—Microstrip antenna, Return Loss, VSWR**

I. Introduction

In telecommunication, antenna is one of the important elements of the wireless communications systems. According to the IEEE Standard Definitions, the antenna or aerial is defined as "a means of radiating or receiving radio waves" [1]. A microstrip or printed antenna is an antenna fabricated using microstrip techniques on a printed circuit board. Because of their simplicity and compatibility with printed-circuit technology. Microstrip antenna operates at microwave frequencies. Microstrip patch antenna consists of a patch of metallization on top of a grounded substrate. The conducting patch can take any shape such as rectangular, circular, triangular. The rectangular and circular configurations are mostly used. Recently triangular shape antenna has gained attraction due to small size requirement. It is very simple to construct by using a conventional microstrip fabrication technique. Applications of microstrip patch antenna are in radar for telemetry, aerospace, global positioning system, mobile communication devices etc.

II. LITERATURE REVIEW

Triangular patch antenna, with its small volume, light weight, easy and active circuitry integration advantages, in the past years has gained more and more attraction with the rapid development of wireless communication.

"Equilateral Triangular Microstrip Antenna for circular polarization dual band operation", Rajesh K Vishwakarma, J.A Ansari, M.K. Mishram. In this paper, the radiation characteristic with two layer triangular patch antenna is examined on equilateral triangular microstrip antenna. At frequencies 3 and 3.5 GHz, the two layer triangular patch radiates maximum power, VSWR, return loss. Design of two layer equilateral triangular patch antenna for dual band operation with good circular polarization is also shown to be possible. From the figure 1 it can be seen that radiation power is maximum along the on-axis direction both for co-polar and cross polar case. The radiated power degrades in the off-axis direction.[2]

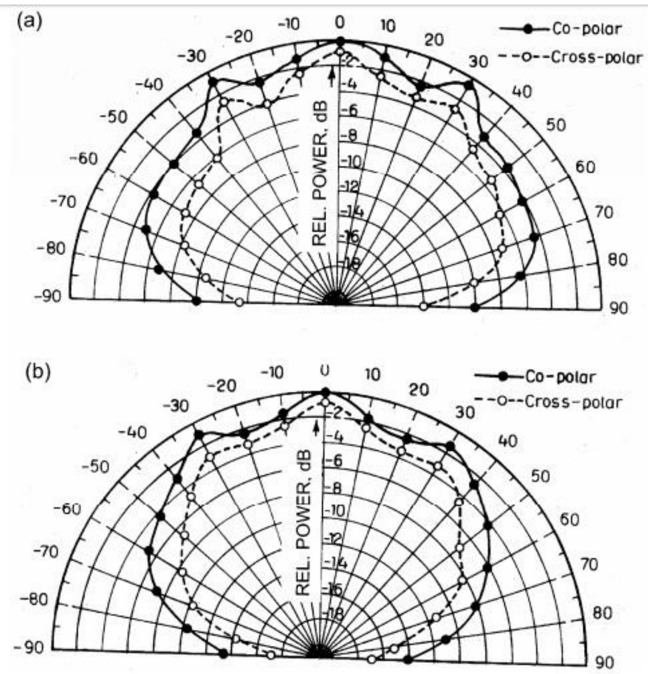

Fig 1: Radiation pattern in two orthogonal plane at (a) f=3 GHz and (b) f=3.5 GHz

"Equilateral triangular microstrip patch antenna with spur lines embedded", F. Malek, M. Md Shukor , H. Nornikman , M. S. Zulkefli , H. M. Mat ,B. H. Ahmad ,M. F. Abd Malek **.** This paper presents an equilateral triangular microstrip antenna with spur lines. The proposed antenna comprises a triangular planar patch element embedded with two spur line slots. The simulation result is compared with the fabricated antenna. The targeting frequency of this antenna is 0.90 GHz (first resonant frequency) and 1.80 GHz (second resonant frequency). The proposed antenna can improve the bandwidth of GSM 1800 up to 100 MHz. It is seen that the return loss of **-** 16.176 dB, bandwidth of 33 MHz (0.919 GHz to 0.952 GHz) and a gain of 3.52 dB first resonant frequency. At second frequency, the return loss are **-** 28.159 dB with a bandwidth of 115 MHz (1.714 GHz to 1.829 GHz) and gain of 3.380 dB.[3]

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"Design of Triangular Microstrip Patch Antenna at Super High Frequency", Sunil kr singh ,Shirish kumar Jain. This paper presents a design for broad band triangular microstrip patch antenna using probs fed. Return loss at the centre frequency is -12.48 dB at 10.075 GHz. The VSWR bandwidth of the proposed antenna is extremly closer to the value of 1.5 and the VSWR at the centre frequency is 1.4. The geometry of the proposed antenna using a broadband operation fed by a probe is shown in fig.1. The proposed antenna is constructed on a dielectric substrate which has a dielectric constant 3.27 ,& loss tangent .002 . The area of the triangular patch antenna is situated on the substrate with dimension1/2(30×18) The antenna is a broadband triangular microstrip patch antenna at the center frequency fc is 10GHz. It is shown that the resonant frequency lies between X & Ku band.[4] Application of this design is in radar and telecommunication

"A Design of Dual Band Triangular Microstrip Patch Antenna for WLAN Applications", Mr.P.Arunagiri, Naveen Kumar C , Adhavan K.[5] A triangular microstrip patch antenna is designed to improve the shortcomings of the previous antennas designed in rectangular, square and elliptical shapes such as high return loss and low gain. Dual band is achieved by introducing dual slot to the antenna (i.e. two operating frequencies 5.15–5.35 and 5.725–5.825 GHz are introduced).The compactness of the antenna design is improved by the equilateral shape of the antenna. The gain is enhanced and return loss is reduced by introducing a Koch boundary. The value of return loss for triangular microstrip antenna is measured. The return loss is a measure of impedance matching and it is around -12dB. The antenna proposed has successfully increased the gain to 6.2 dB at 5.2 GHz and 5.8 GHz. The return loss is also considerably reduced to -38dB with introduction of Koch boundary for an equilateral triangle antenna. This makes the antenna more reliable for WLAN applications. Table clearly indicates that when the Koch boundary is added to the triangular microstrip patch antenna, the return loss is reduced and the gain is increased.

PARAMETER	WITHOUT KOCH	WITH KOCH
Gain (dB)	5.6	6.4
Return Loss (dB)	-12	-38

"Design of Equilateral Triangular Microstrip Patch Antenna with Co-axial Feeding Technique", Mr.V.V.Khairnar Prof.B.V.Kadam Prof.K.R.Khandagle. This paper presents design of equilateral triangular microstrip patch antenna , for wireless communication systems, with operating frequency at 2.45 GHz. The Industry, Scientific and Medical (ISM) Band is used as the operation band. The maximum bandwidth can be achieved by controlling the distance between the patch antennas and by adjusting the probe feed position. Return loss of -29 dB with VSWR 1.05 at 2.45GHz. The results show that the proposed antenna has the impedance bandwidth of 80MHz. The antenna parameters are investigated and optimization is performed by varying the feed position and substrate dielectric constant. The input and radiation characteristics are examined and compared. For different feeding positions, the return loss was measured. Result is shown in fig 2. At S/2.3 co-axial feeding location, maximum return loss is obtained. The feeding point coordinates can be given as, P(X,Y,Z)=(X,18.5,0).So X is changed along the length of equilateral triangle. The results demonstrated that the bandwidth and radiation properties of the antenna with triangular slot have better performance than the antenna without triangular slot. The antenna was designed to have a good return loss and radiation pattern. The corresponding return loss obtained from simulation is - 29.03 dB and VSWR is 1.0538. VSWR plot is shown in fig 4. while the resulted directivity of array antenna is 6.16 dB .The value of impedance is passing through 1 on both the smith chart ,it shows perfect matching of probe impedance and patch impedance. Impedence plot, radiation pattern and smith plot is shown in fig 4, 5 and 6 respectively. It is also shown that the geometry with triangular slot has an influence towards the performance of the antenna characteristics.

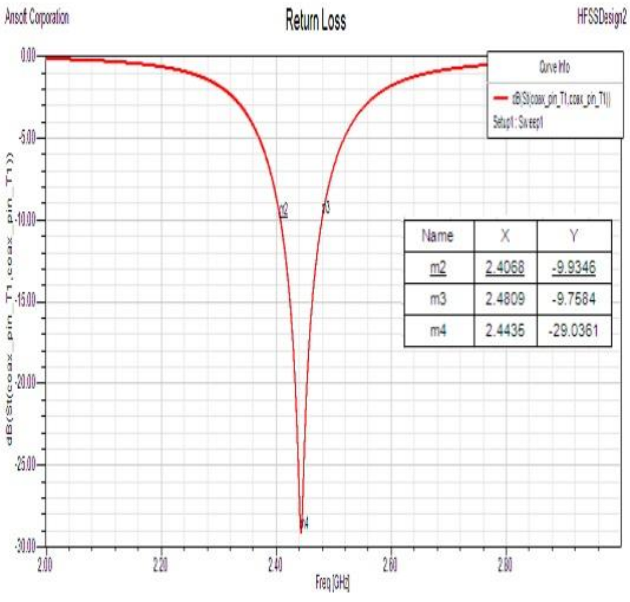

Fig 2: Return Loss

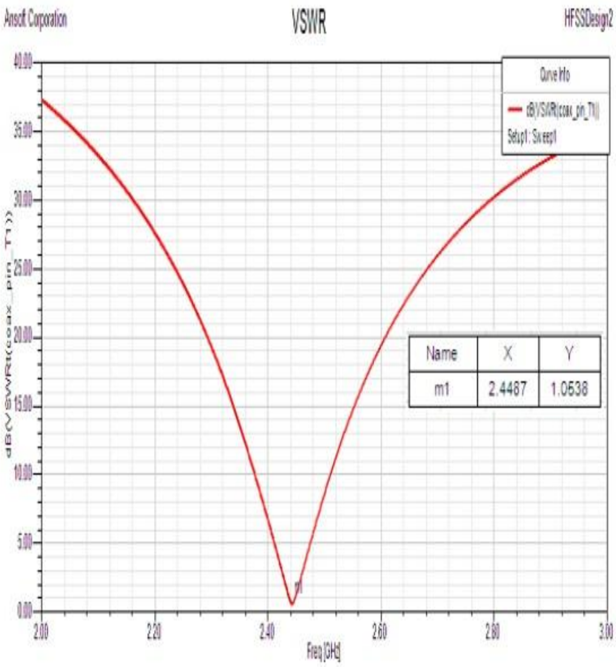

Fig 3: VSWR

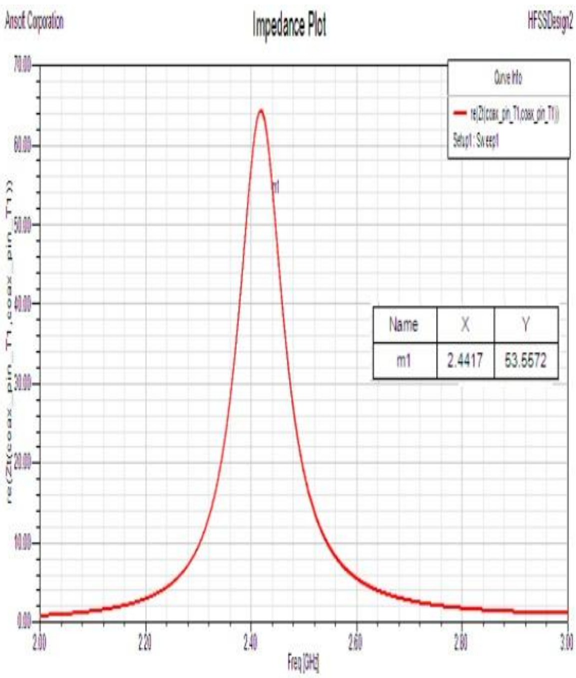

Fig 4: Impedence plot

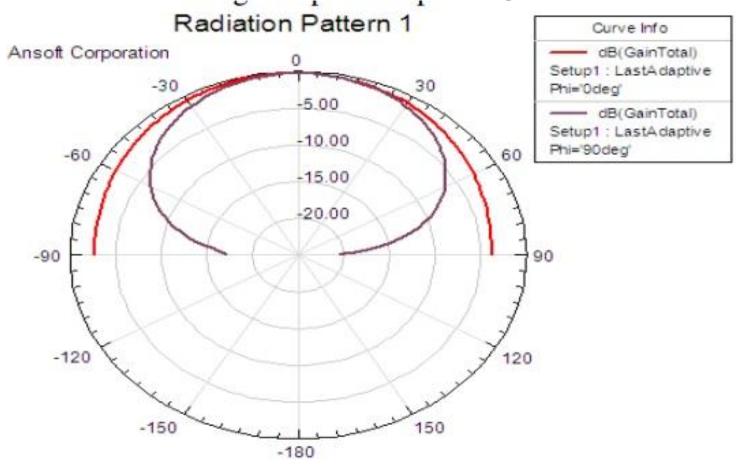

Fig 5: Radiation pattern

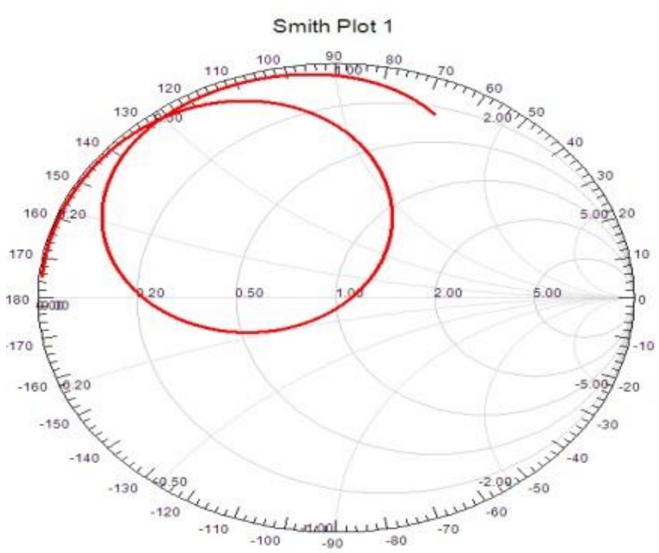

Fig 6: Smith plot

III. Conclusion

The triangular patch antenna is advantageous over other shape antenna characteristics. This paper present some techniques for enhancing the different characteristic as radiation pattern, bandwidth, return loss, V.S.W.R etc. The result demonstrated that the radiation properties of triangular antenna have better properties than other antenna shapes. As future scope, the antenna characteristics can be further improved by using high order fractional techniques.

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