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An Innovative Feeding Technique for Linearly And Circularly Polarized Ultra Wide Band Micro Strip Patch Antenna

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***Abstract*-In this paper, an innovative feeding technique has been applied on a simple square micro strip patch antenna and its design variations in shape of the copper lamination embedded on the surface of substrate volume being 40x40x1.56 mm^3. The feeding technique has resulted to generate an ultrawide band from 100MHz-100GHz with ultrawide bandwidth of 0.1GHz-54GHz with sufficient gain and proper reflection coefficient below -60dB . The patch has been fed by coax feed which has been designed by replacing the inner and outer conductors with vacuum(no conductors) and the patch is in line fed by a via and wave port is assigned below the feed point but at the moment ,it seems little bit difficult to practicalize. The analysis has been carried out by HFSS.**

***Keywords:* Gain, Reflection coefficient, Band width, coax feed, HFSS**

I. Introduction

There is a demand of such an antenna which can be employed for as large as possible range of frequency in electromagnetic spectrum for maximum range of applications and in the previous years , much more work has been performed by various professors, engineers ,researchers and scientists. For enhanced band width ,many techniques have been developed. Extremely Small monopole antenna was reported for a band of 5.25–21.61GHz for wideband applications [1].Triple U-slot loaded defected Ground plane antenna was published for use of approximate 9.4-14.5GHz for Multiband operations [2] . A micro strip Antenna with defected ground was developed for 2-21GHz which covers L,S,C,X ,Ku and some vestige of K band for bandwidth enhancement and Cross-polarization suppression in ultra wide band [3].Circular ring two element microstrip patch antenna array for modern wireless applications was put forth for use in 1.0-13.8GHz [4]. Design and development of U-notched corner truncated Square microstrip antenna was reported for 7.53-18GHz for X to Ku band operation [5]., a compact hut-shaped printed antenna was published for 0.9-22.35 GHz for super-wideband Applications [6].

UWB antennas should be effectively utilized in transmitting and must incorporate compact, non dispersive, and a good wide impedance bandwidth properties, these features are mostly desired for both indoor and outdoor hand−held UWB applications[7]. Wide-Band Modified Printed Bow-Tie Antenna was proposed with Single and Dual Polarization for *C*– and *X*-Band applications for use of 5.5 -12.5GHz[8]. Though many antennas with different feeding methods have been suggested in past and text books ,yet the proposed antenna feeding technique is an innovative and novel one. In this paper, the technique for feeding input power has been designed and oriented at different structure of antennas and it creates a super ultra wide band frequency range of 0.1GHz -100GHz which covers approximate one third microwave electromagnetic spectrum with sufficient low VSWR and reflection coefficient in terms of S-parameter with filtering properties.

II. Antenna Geometry With Innovative Feeding Technique

The micro strip patch antenna of rectangular shape of 16.4x15.5mm^3 size designed on FR4 substrate(ε_r=4.4,loss tangent =0.02) of 40x40x 1.6mm^3 with a finite conductivity ground plane of 35 μm displaced at a depth of 1.2mm from its bottom surface. The coaxial feed with a center vacuum pin of 0.5mm radius and a height of 2.76mm at centre position (0,8.85) is inserted upto the feed strip patch of 3.7mm x 1.2mm coupling the micro strip patch radiatively with a gap of 0.5mm and outer vacuum coaxial cover is put behind its circular cut of radius 1.6mm into finite conductive ground plane. Antenna geometries associated with equilateral triangular cuts are exhibited in figure1 in which (a) Ant1 without any triangular cut,(b) Ant2 with one triangular cut T_1 at [C.P(0,-6.36) , S.P(0,-3.36)],(c) Ant3 with two triangular cuts T_1 and T_2 at [C.P(0,-6.36) ,S.P(0,-3.36)] and [C.P (6.8,0) ,S.P (3.8,0)] and (d) Ant4 with three triangular cuts T_1 , T_2 and T_3 [C.P(0,-6.36), S.P(0,-3.36)], [C.P (6.8,0), S.P (3.8,0)] and [C.P (-6.8,0), S.P (-3.8,0)] are shown where C.P and S.P represent Starting and centre position.

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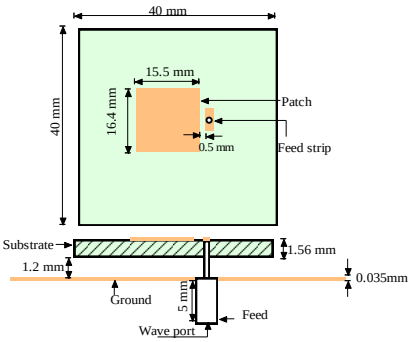
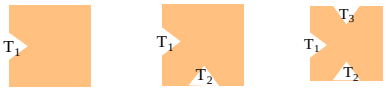


(a)



(b) (c) (d)

Fig.1 (a) Antenna1 without any triangular cut (b) Antenna2 with one triangular cut T_1 (c) Antenna3 with two triangular cuts T_1 and T_2 (d) Antenna4 with three triangular cuts T_1 , T_2 and T_3

III. Results And Discussion

Fig.1 shows return loss in terms of S11-parameters and it shows its -10 dB bandwidth . In the figure ,the value goes upto less than -50dB and all the designed antennas cover a range of 55GHz .Beyond the value, All the structured antennas show ripples in graph and it shows filter like properties and do not pass the band 55-60GHz to radiate but all the antenna designs radiate multiple wide bands.Fig.2 shows the voltage standing wave ratio at 1 upto 55GHz and after this frequency ,there exist ripples in the graph and selected range of band width is passed. Fig.3. shows the gain to be positive greater than 0dB and it indicates the patch radiates well .Fig.4. shows the radiation efficiency initially increasing upto 15GHz and decreasing beyond it. Fig.5. shows the axial ratio falling upto less than 3dB at some frequencies indicating the antenna to be linearly polarized and at some other frequencies, the axial ratio remains well above 3GHz and antenna is said to be circularly polarized.

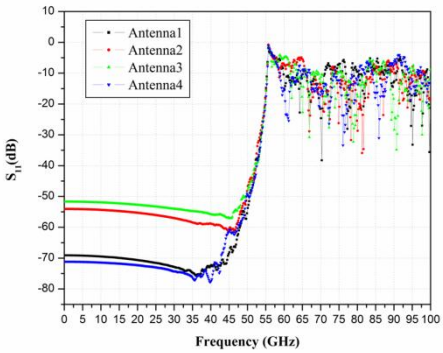


Fig.1. S_{11}(dB) versus Frequency graph

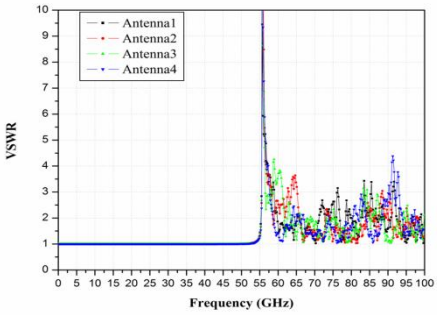


Fig2.VSWR vs Frequency graph

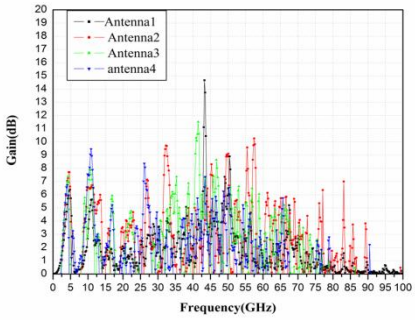


Fig.3 Gain vs Frequency (GHz)

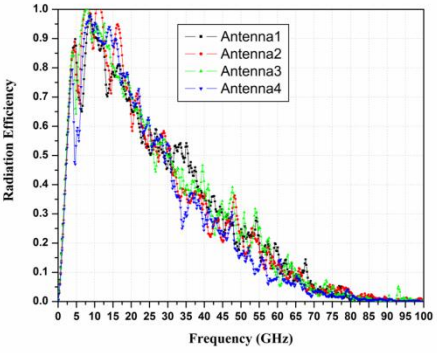


Fig.4. Radiation Vs Frequency Graph

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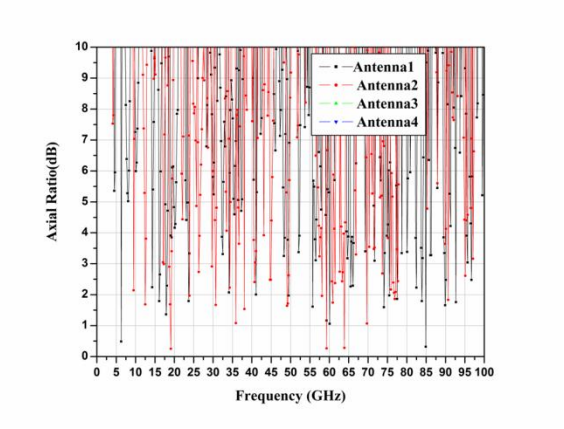

Fig5.Axial ratio vs Frequency graph

IV. Conclusion

It can be concluded that the proposed feeding technique results in better results in terms of return loss ,VSWR, Gain ,radiation efficiency and Axial ratio. Antennas designed with such a techniques can be utilized over large ultra wide band width.

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