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An Ultra High Bandwidth Microstrip Antenna for Upper L-Band and Lower S-Band Applications

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Abstract: Communication on microwave frequencies have multifold advantages and as far as wireless communication is concerned, it requires an perfectly matching antenna too, for this reason plenty of research work is going ahead in the field of Microstrip antenna at many frequencies now a days. This paper has a wider role and significance in the development of Microstrip antenna because the simulation has been done on a frequency on which many important communication devices are working i.e. 2 GHz. A novel microstrip antenna has been presented in this paper, this antenna achieves bandwidth of 60.80% when simulated on IE3D platform and retains 52.80% of bandwidth when tested using spectrum analyzer. As a matter of fact high bandwidth antennas are always desirable, this novel shape may be helpful for the various applications of higher L and lower S band application.

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Introduction: During last two decades great research work has been done for bandwidth-widening with the help of many techniques like [6] U-slot, Normal slots, slanting edges, stacking, shorting pins [10] and shorting patches. In this paper an ultra-high bandwidth antenna is proposed with slot technique and slanting edges, the bandwidth of the proposed antenna is 60.80% which is quite large and usefull. Obtaining high bandwidth at high range of frequencies is easier but they have less utility because of their high cost peripherals and because of their high running cost.

In this antenna four slots have been etched out from the radiation surface. The shape of the antenna is "Double Sided Arrow Shaped" represented in Fig. 1.Both horizontal ends of the antenna are kept pointed, at the upper and lower points 2 slots at each vertical ends have been taken out to get more resonance for vertically polarized waves but it is purely on hit and trial method which has given good resonance, similarly one more sharp edge at the upper side has designed blunted to get more resonance for horizontally polarized waves, the next attempt to get more bandwidth is done by making a slot near to the upside blunted edge.

All the factors including the slotting technique and slanting edges worked together to get a usefull pattern of the bandwidth. The antenna has co-axial probe as feed point near to the cut slot.

Substrate Selection- The first design step[1] is to choose a suitable dielectric substrate with appropriate thickness and appropriate value of loss tangent. A thicker substrate is not only being mechanically strong but also will increases the radiated power, reduce conductor losses and improve impedance bandwidth however it will also increase the weight, dielectric loss, surface wave loss and extraneous radiations from the probe field. The substrate[2] taken for the designing is Glass epoxy which is very cost effective (Rs. 900 for 1 Sq. foot) and possesses nearly all appropriate characteristic for designing an antenna, value of h is 1.6 mm and loss tangent is 0.02.

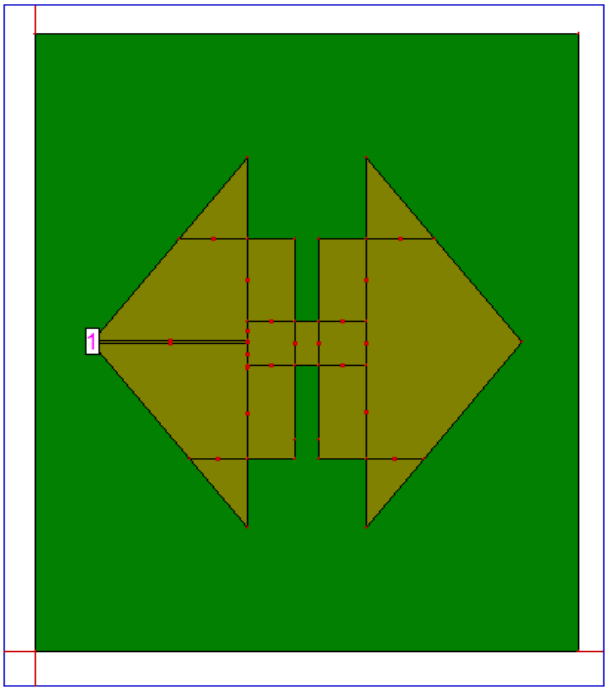

Fig. 1 : IE3D Geometry of Proposed Broadband Antenna

Antenna designing- Microstrip antenna has a fixed and

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sophisticated procedure of designing in which first we calculate the width and length of the resonating [5] patch and then the calculation of the Width and Length of the ground plate is to be done, values of W and L of the radiating patch for 2 GHz is 36.24 mm. and 46.48 mm. respectively and then *Wg* and *Lg* can be calculated with the help of formulas.

IE3D Simulation Results

Zelands Software's IE3D is a platform where we can find out the performance of the antenna few important parameters of the proposed design are calculated and find as below

Slot Dimensions : (10 mm,15 mm), (2 mm, 15 mm)
(10 mm, 15 mm), (2 mm, 15 mm)

Feed Location(X_0,Y_0) : (4.85, 28.05)
Broadbanding technique used: Slotting, Slanting Edges

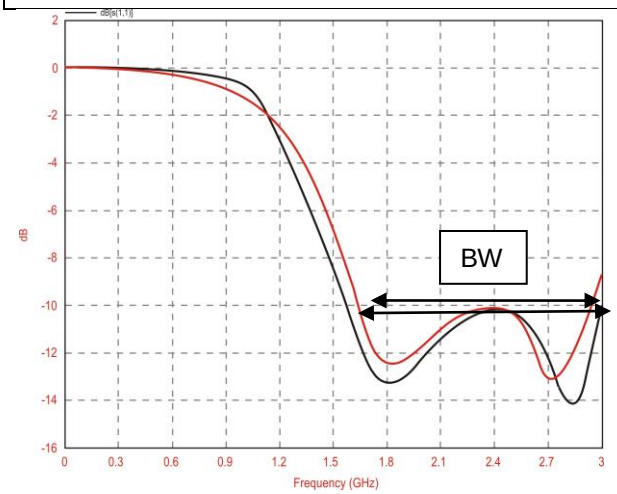

Fig.2. Return Loss comparision of Proposed Antenna

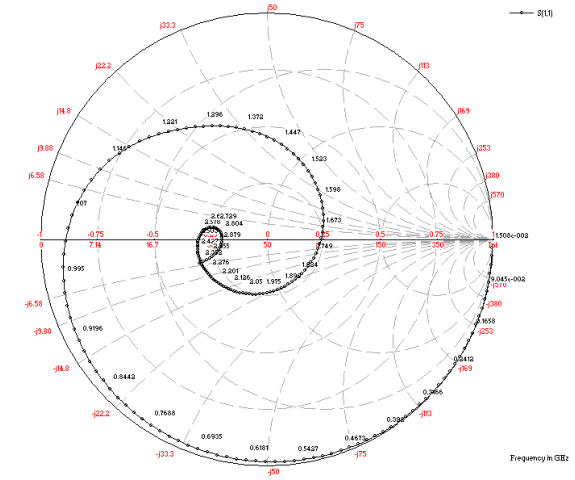

Fig.3. Smith Chart of Proposed Design

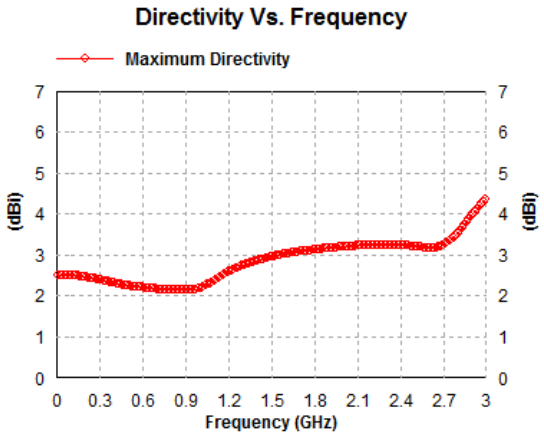

Fig.4. Directivity Vs. Frequency Graph

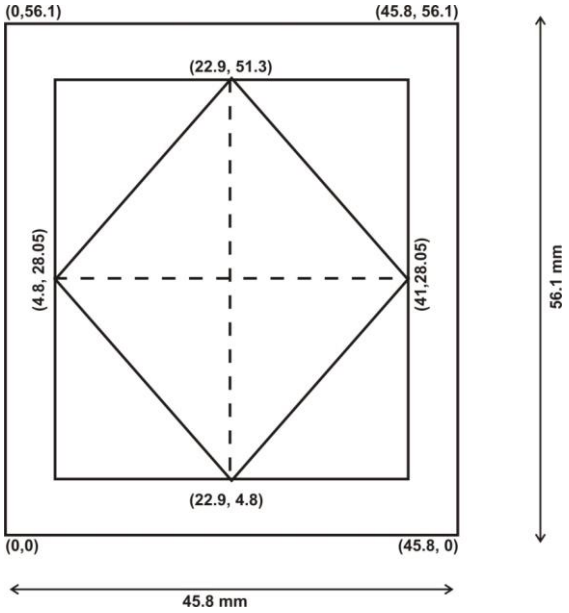

Fig.5. Basic Architecture of Antenna Before Slot Cutting

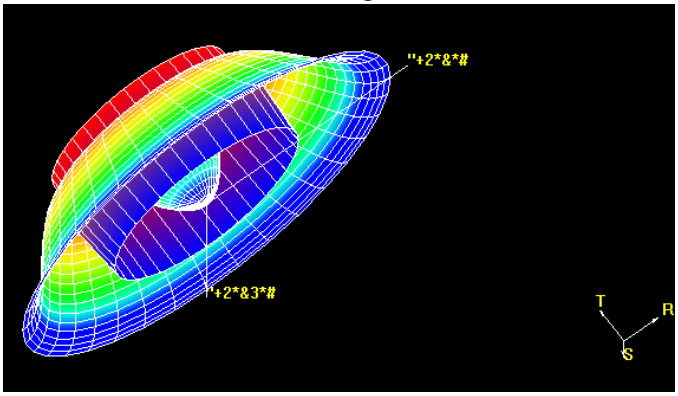

Fig.6 .Radiation Pattern of Praposed Antenna

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Fig.7. Size Comparision of Proposed Novel Shape

Parameters Discussion – Figure-1 shows the top view of proposed antenna where the designed slots are clearly visible, in Figure-2 Frequency Vs. Return loss graph has been represented, desired return loss value is starting from 1.6 GHz frequency and lasts upto 3.0 Ghz as far as response of simulator is concerned, during testing the upper cut off frequency is 2.93 GHz and lower cut off frequency is 1.7 GHz which is leading a bandwidth of 52.8%. In figure-3 Smith chart performance can be concluded, Figure-4 is of directivity Vs. Frequency graph, Figure-5 shows the the basic diamond shape geomatry which has been initialy designed on IE3D and then 4 slots have etched out, in Figure-6, Radiation pattern of the designed antenna can be seen and Figure-7 shows the size comparision of the proposed design.

Conclusion – Slot cutting and slanting edges are two very effective techniques of increasing the bandwidth of the microstrip antenna, both the techniques have been used to get better results and wider bandwidth in proposed antenna.
At 2 Ghz many important communication devices are working. This antenna who has a wider bandwith and enhanced parameter will be more usefull for such applications.

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