COMPARITIVE STUDY OF RETURN-LOSS FOR SINGLE AND DUAL INSET-FED MICROSTRIP ANTENNA

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Abstract

A comparison of return-lose for different configuration of inset-fed microstrip patch antenna is shown in this paper. Here single patch of microstrip antenna is fed by single and double inset-microstrip feeds separately in different configurations (i.e. their dimensions are kept same only numbers of feeds are changed); their returnloss and bandwidth at 1 to 10 GHz frequency range is then compared.

Keyword: Microstrip patch antenna, inset-feed, returnloss, bandwidth, HFSS 11.

1. INTRODUCTION

Main reason for the use of microstrip patch antenna is its low profile, conformability, ease for mass production and are suitable for personal mobile communication. There are some commercial applications of microstrip patch antenna such as its medical relevance, satellite communication and GPS. Microstrip patch antennas are also used in wireless communication, aircraft tracking system, missiles guiding system and in various military applications. To support these applications microstrip antenna should have good returnloss as well as VSWR value and bandwidth. Microstrip antennas are compact and cheap as compare to other types of antenna because of their manufacturing process; they are manufactured by etching metal grounded substrate. The paper presents different configuration of microstrip patch antenna employed with different feeding techniques. Spotlight of this research paper is returnloss comparison of different feeding arrangements.

2. ANALYSES OF DIFFERENT FEEDING TECHNIQUES

There are different ways to feed microstrip antennas each have its own advantages and disadvantages. In Microstrip feeding a conducting metal strip is directly connected to one edge of radiating patch. Strip line has some width which increases the surface waves and some specious feed radiation also increases. Second type of feeding is coaxial feeding technique, in this technique a probe feed is used to excite patch, this probe penetrate through the substrate to the patch. This probe can be placed anywhere at patch to obtain desired input impedance. It provides narrow bandwidth and covers more space which is its main drawback. Third type of feeding is Aperture Coupled Feeding; here patch and feed are separated by ground plane and coupling between patch and feed is made through an aperture in ground plane. This type of configuration is generally difficult to fabricate and it also increases the thickness of antenna. Another type of feeding is electromagnetic coupling feed line is placed between two substrate and patch on the top of upper substrate. It reduces the spurious feed radiation and increases bandwidth.

Some patches are fed by coaxial feed one such design is given for bluetooth application [1]. The VSWR, gain along T,Ø directions, axial ratio, E and H field distribution, radiation pattern in 2-D and 3-D and current distribution parameters are taken into consideration. In UHF band frequency range of 540-890 MHz applicable for terrestrial DTV signal reception low profile co-axial fed spiral slotted microstrip patch antenna is proposed taking gain along Ɵ,Ø directions, return loss, radiation pattern in 2-D and 3-D, VSWR, E and H-field distribution, current distribution and axial ratio into consideration [2]. Elliptical polarization is achieved by this configuration. Some other configurations of patch antennas are fed by inset microstrip feed. The inset microstrip feed reduces input impedance if the patch is fed closer to the center, current at the ends of half-wave patch and magnitude is increased towards the center [3].

In a study of comparison between coaxial and strip line feeding the gain obtained from a square patch are closer to each other. Gain obtain are 8.40 dBi and 8.47 dBi for coaxial and strip line feed respectively [4]. For proximity coupled microstrip patch antenna at operating frequency 2.45 GHz gain of 6.4 GHz is obtained [5].

3. LITERATURE REVIEW

In this section various feed concerning papers are reviewed. Anamika Singh et al. has contributed novel c-shape slotted microstrip patch antenna with high gain for wireless systems. The maximum gain obtained at 2.31610GHz is 7.31541 dB; bandwidth is 50% from 1GHz to 3GHZ, radiation and antenna efficiency are more than 95.5319%. The proposed antenna is suitable for wireless applications Wi-Fi and Wi Max. The gain, directivity and efficiency of the proposed antenna are increased with reduction in return loss. IE3D simulator is used for simulation [7].

Younkyu Chung et al. has contributed high isolation dual-polarized patch antenna using microstrip line feeding integrated with defected ground structure. Improvement of 20 dB as compared to conventional patch antenna in port isolation is seen by analyzing the result at operating frequency 2 and 2.5 GHz. The 75Ω microstrip feed line with defected ground structure (DGS) provides image impedance of 150Ω without modifying the width of the line. DGS improves port isolation for dual-frequency orthogonally polarized patch antenna [8].

Gonca Cakir has contributed microstrip patch antenna arrays for better cellular communication coverage with 20^0 - 35^0 beamwidth. The proposed antenna array is designed with 35^0 beamwidth and 60^0 electronic scanning capabilities. The arrays are designed for 1.8 GHz cellular wireless communication systems [9]

Yongxi Qian has contributed a technique known as photonic band - gap (PBG) for gain and bandwidth enhancement of patch antennas The Ku band implemented provides 3 times bandwidth improvement, gain increased to 1.6 dB and increase of 45% in effective radiated power(ERP) as compared to conventional patch antenna. The advantages of this technique are improved gain, wide bandwidth, lower backside radiation, surface wave suppression at microwave and millimeter –wave frequencies [10].

4. ANTENNA DESIGNING

In this paper two configurations of inset fed microstrip antenna are compared

4.1. Single Inset Fed Microstrip Patch Antenna

Configuration of this antenna is shown below.

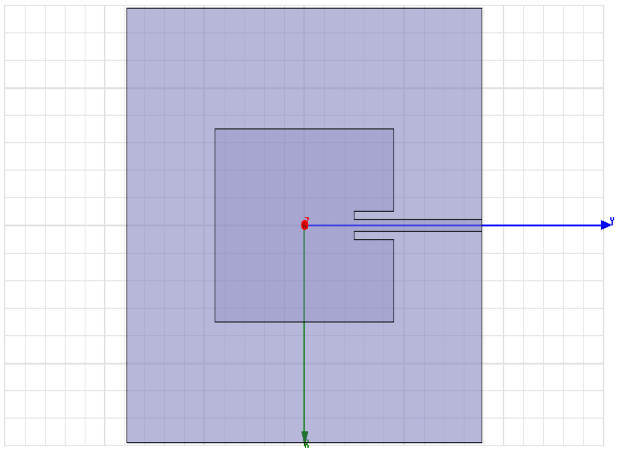

Fig. 1: Single inset fed microstrip antenna.

Here 35 mm long inset feed is used to excite the patch with 12 mm long and 5 mm wide slot. Size of patch is 35X45 mm^2. Substrate with 4.4 dielectric constant and 1.6 mm height is used. Result of this configuration is shown below in figure 2.

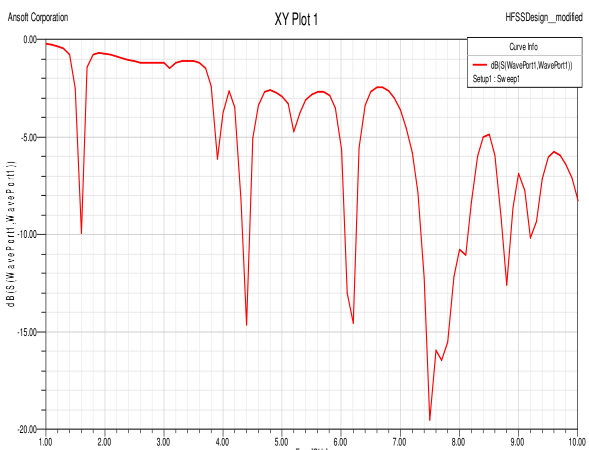

Fig. 2: Return loss vs. Frequency for single feed microstrip antenna configuration.

At dimensions shown above maximum return loss achieved is 19.5 dB at frequency range of 1 to 10 GHz.

4.2. Patch with two microstrip feeds

Here in this configuration all dimensions are kept same, but two feeds are used which are at opposite sides of each other. Configuration is shown below in figure 3:

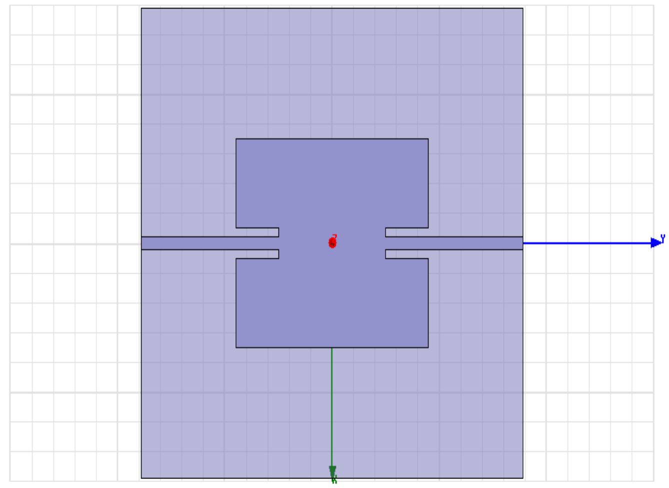

Fig. 3: Microstrip antenna with two inset feeds.

Return loss vs. frequency results are shown below:

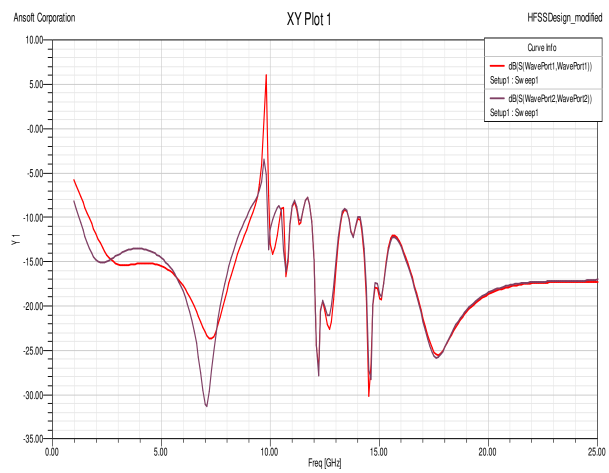

Fig. 4: Return loss vs. frequency result for configuration shown in figure 4.

Here return loss of about 32 dB is achieved with wider band. A wider band from 1.5 GHz to 9 GHz is also obtained.

5. Table of Analysis

S No.	Configuration	Dimensions	Analysis
1.	Single Fed Patch	1. 35X45 mm^2 Patch 2. 35X3 mm^2 Single Feed	Return loss of about 19.5dB is obtained with wider band.
2.	Dual Fed Patch	1. 35X45 mm^2 Patch 2. 35X3 mm^2 Single Feed	Return loss of 32 dB is obtained with narrow band.

6. CONCLUSION

After analyzing the results of two different configurations, patch with dual inset feeds yields better results in terms of return loss as compare to patch with single inset feed. Results obtained are 32 dB and 19.5 dB for dual and single fed patch respectively. Even bandwidth produced by dual fed patch is broader than patch with single feed.

REFRENCE

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