Enhancement of Gain & Bandwidth Microstrip Rectidollar Patch Array Antenna for Satellite Applications

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Abstract: Over few decennary there is fastest growth in the field of satellite communication and it has its wide application in this field. There is many variety of antennas which can be used for satellite applications and the preference is given to microstrip antennas because of its merits and applications. This research includes the designing of a rectidollar patch array. In this the feeding given is microstrip feeding. The whole desigining process as well as the simulation is done on the software names HFSS. The material used for deigining is Fr4 epoxy. In this research work major aim was to increase the gain and the bandwidth of patach aaray antenna. The enhanced result was gain from -5db to -8db

Keywords: Microstrip antenna, Miniaturized,Return Loss, Gain & Bandwidth, Automotive Radar Systems, Navigation.

I. Introduction

Satellite Communication, terribly speedy growing technology of the comm. firm is that term which means while not victimization wires between contract points. Several areas like satellite sensors networks, fully absolute automatic organization and industries, remote areas, digitized home and appliances, intelligent transport systems, etc. are emerged from analysis concept to sensible hardiness. Hence, satellite communication has attracted the eye of the media and imagination of public. The complete area of satellite communication was revolutionized with the advancements in microwave systems, comprising of microwave components and circuits which achieve to tiny size and low cost satellite communication systems. [4] as in recent years the telecom and satellite communication industry is rapidly growing and the satellite communication, laptop, mobile and other satellite communication accessories are become the common need of today's lifestyle.

It needs Microstrip fed-slot antennas contains better bandwidth range and it have quite simple in design and thus this can be built easily and the cost of manufacturing is very low and thus this techniques is more suitable to use for the wireless networks and Bluetooth applications. [4] as there is an sudden advancement in the use of wireless technique from a mobile to mp3 player, from a printer to the international receiver, the medical equipments use in the hospitals, and even in lab researches we uses wireless operations. As the antenna

technology is going through a wide range of changes from the long wired communication links to the applications in defense, and even the use of antenna in missiles, aircraft system, space applications. [5] these fields are quite developing and shows the drastic changes in development of cellular mobile personal communication. As in previous we use audio service support circuit switch communication which is an old thing now. The most common use of high data rates is the use of video telecommunication by the help of wireless networks. 3rd Generation GSM (3G), Wide band-CDMA, Wireless Fidelity (Wi-Fi), 4th Generation Wi-Max, Wire1ess-LAN, is all towards this direction.

In recent era, the event in communication system needs development of tiny size electronic system .Now a day, there's a requirement of tiny size & low prize microstrip antenna. Microstrip antenna is wide employed in wireless communication applications. Microstrip antenna has tiny size, terribly low price, and simple in fabrication & provides high performance over wide band of frequencies. In this thesis, I propose a brand new approach for coming up a very tiny size patch antenna with UWB Substrate. This antenna is employed to transmit & receive radio signal at resonant frequency of 10.5 GHz. At resonant frequency of 10.5 GHz, the antenna concentrates energy through a direction to present a more robust radiative performance. In this study our main focus is to study and learn about stimulation of microstrip patch with UWB and also to study the effects of antennas parameter like its length, intensity frequency, and other parameters like permittivity (ε), thickness (t) on the various parameters of radiation of bandwidth .

As in 1970s when these microstrips are evaluated become very popular for the space applications and in recent years it becomes used for the commercial application in industries. In microstrip we have a metal patch on its substrate and other patch on ground plane .

The rest of paper is design as follows. Section II describes the design of UWB antenna with their dimensions. Performance parameters are described in section III. The overall past work is describe in Section III. Advantages & applications describe in section V & VI respectively.

2.1 Rectidollar Patch Antenna Design

A rectidollar patch antenna is designed and simulated. The propose methodology of research work is optimized design of antenna with proper feed. In proposed antenna coaxial feed technique is used. The firstly we design the substrate having dimension 20 × 20 × 1.6 mm. The substrate has material Fr4 and substrates is used with ε_r = 2.33 with 1.6 mm thickness.After designing the substrates, on the top side of the substrate, a radiatingpatch is printed with feeding points (-10,-10,0). The placement of ground plane is full size on the opposite side of the substrate. The major purpose of the overall work is to enhance the bandwidth & decrease return losses.

The proposed antenna is designed and simulated using the software called High Frequency Simulation Structure (HFSS) software. The patch is operated at different frequencies of 2.4 GHz and 5.2 GHz respectively.The basic schematic design of rectidollar patch antenna configuration is shown in the figure 1.

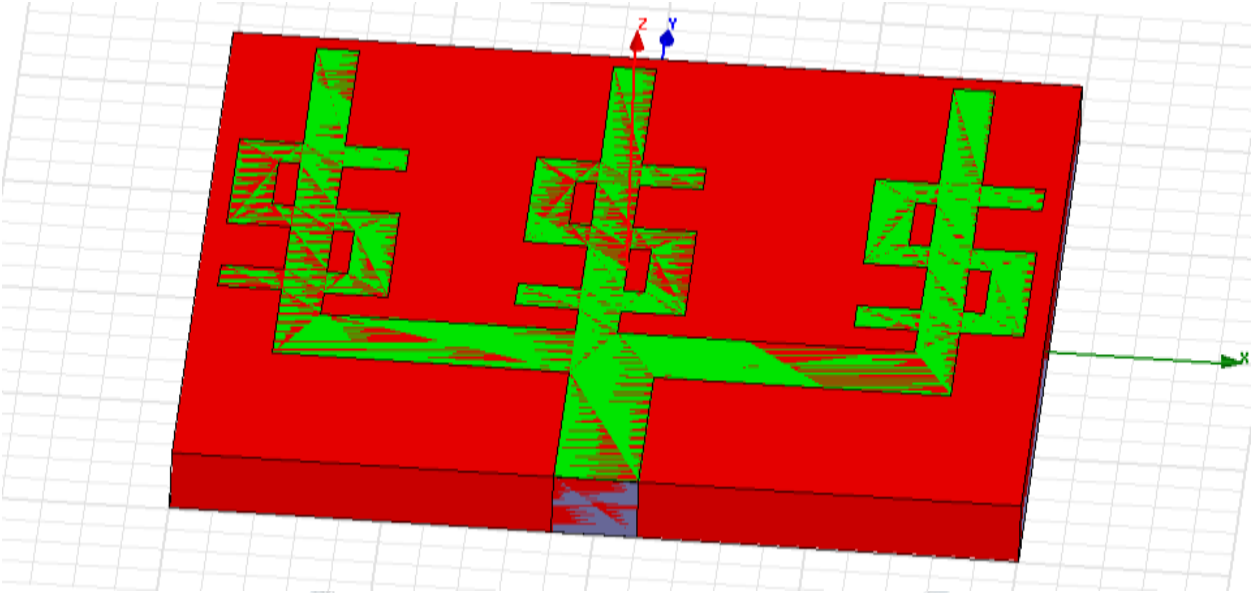


Figure 1: A Proposed Patch Array Antenna

The performance parameters of antenna is to be improve are gain, directivity, bandwidth and return loss. These parameter are as [21]:

1. Directivity is measure as the ration between the intensity of the radiation a given direction to the radiation intensity in every direction.

$$D = \frac{4\pi U}{P_{rad}} \quad \ldots\ldots\ldots\ldots \quad (1)$$

2.Gain of antennas is measure as the ration between the radiation intensity in a given direction to the radiation intensity when the power require by the antennas is radiated isotropically.

$$Gain = 4\pi \frac{Radiation\ Intensity}{Total\ Input\ (accepted) Power}$$

3. the bandwidth is define as the range of the frequency under the performance of the antenna. The bandwidth of the narrow and broad bands are represented as: [11]

$$B.W = F_h - F_l$$

4. Return loss is basically the reflection of the signal power which is obtain from insertion of device in a transmission line. Thus the return loss is given by the formula:

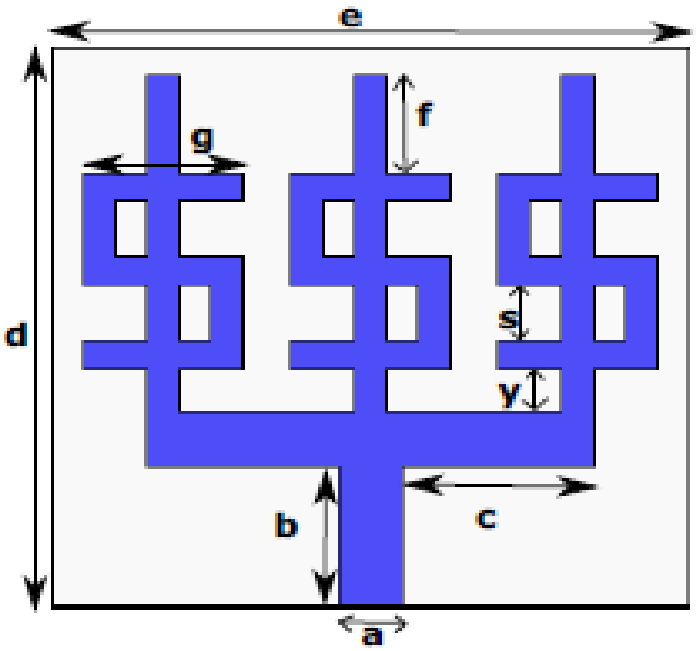
$$RL = 10Log \frac{P_r}{P_i}$$

5. The standing wave ratio (SWR), can not be misunderstood only as the antenna characteristics but we also use it for the describing the performance of antenna when is connected to the transmission line [12] .

$$\text{VSWR} = \frac{V_{max}}{V_{min}} = \frac{1+|\Gamma|}{1-|\Gamma|}$$

DIMENSIONS OF ANTENNA

Parameter	Value (mm)
a	2
b	5
c	7
d	20
e	20
f	1
g	4
h	1
y	4



3. Results and Discussion

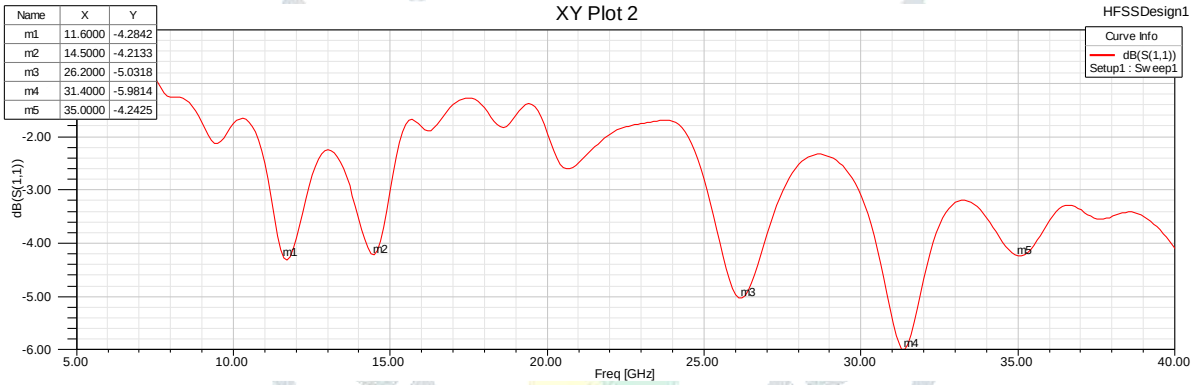


Figure 2:Return loss of the Proposed Antenna

The simulated results for gain that are obtained from the proposed antenna at 16.6 GHz and 18.3 GHz are shown in figure 3 and figure 4 respectively. These figures show frequency versus gain graph. The gain is given in variation of theta & phi and range of theta and phi is taken from 0 to 90 degree.

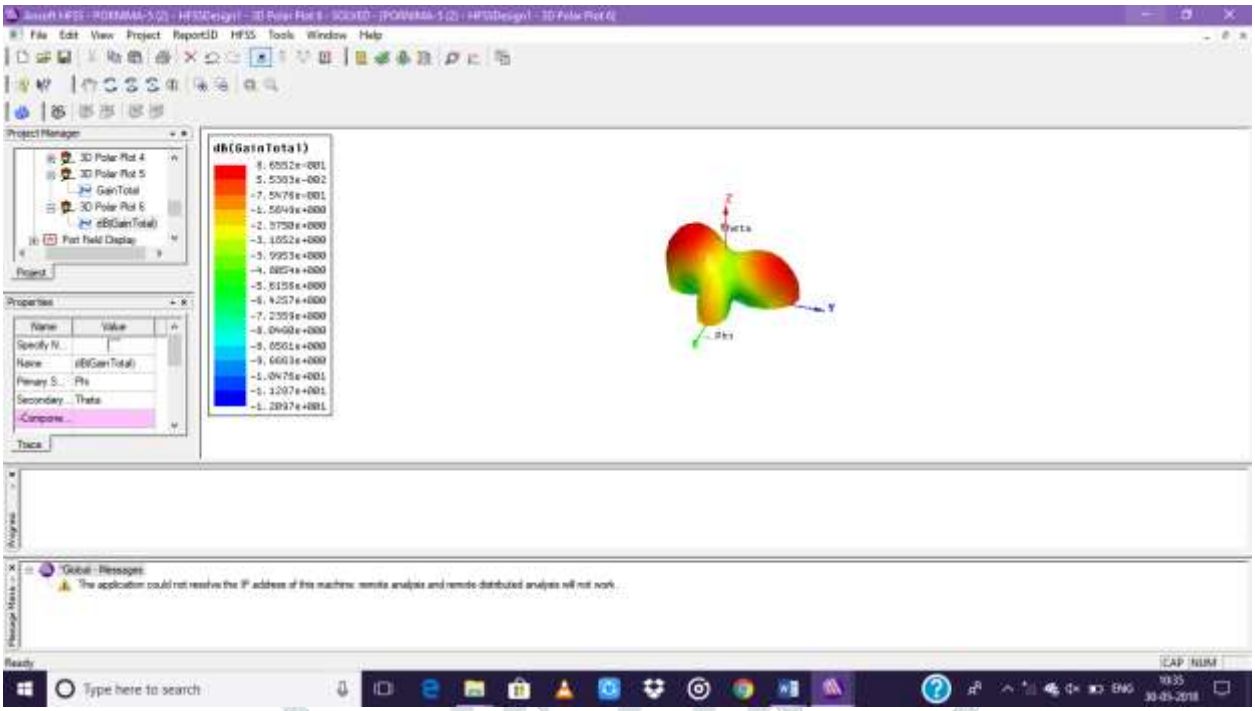


Figure 3: Gain of theProposed Antenna at 15.33GHZ

Table 1.Comparative analysis of Proposed Antenna& Conventional Antenna

Sr. No.	Parameter	Base Paper	Proposed Antenna
1.	Return loss	-1.39 db	-5.7673 db
2.	Gain	5.1 db	8.65 db
3.	Bandwidth	40 MHz	563 MHz
4	Resonant frequency	2.45 GHz	15.33 GHz

4. CONCLUSION

In this research paper presentation of rectidollar patch array which is used for satellite application is done. The patch array antenna most commonly used in modern satellite communication . From the simulated results, it is seen that the performance of the proposed antenna is better than the conventional patch antenna. Future scope is to design another microstrip patch antenna that can operate on higher frequency. The proposed antenna works at 16.6 GHz andobtained return loss of -35.7673 dB with gain 5.6925 dB and bandwidth 563 MHz. Antenna is also operated at 18.3 GHz and obtained return loss of -29.2070 dB with gain 8.44 db and bandwidth 268 MHz.

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