JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DESIGN OF RECTANGULAR MICROSTRIP PATCH 4*4 ARRAY FOR SATILLITE COMMUNICATION

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ABSTRACT

Microstrip patch array antennas are widely used in satellite communication, because of its advantages compared to the conventional antennas. This project presents the design and analysis of a 4x4 rectangular micro strip patch antenna array for satellite communication. Emphasizing optimization for performance metrics such as gain and radiation pattern, the array's design process incorporates substrate selection, patch dimensions, and feed network configuration.

Utilizing advanced electromagnetic simulation tools, the array's performance is optimized to meet satellite communication standards. Practical considerations, including fabrication and performance validation, are discussed. The project aims to enhance satellite communication system reliability and efficiency, with potential applications in telecommunication and earth observation satellites.

This array antenna is made for satellite communication, X-band applications, and KU applications. The antenna array is designed by using HFSS (High Frequency Structure Simulator) and also the simulation has been done by the same software.

Keywords: Antenna, Electromagnetic waves, Transmission, Reception, Microwave, Satillite communication, Wifi, Wave propogation.

INTRODUCTION

The design of microwave and millimeter wave components, the need for more compact and minimalist devices arises. Microstrip antennas are becoming increasingly popular in this regard, as they can be directly printed onto a circuit board. Among the various types of microstrip antennas, patch antennas stand out for their low cost, low profile, and ease of fabrication. They are also small in size, lightweight, and easy to integrate,making them an ideal choice for dual-band antenna design applications such as laptops and smartphones. They are also relatively easy to manufacture and can be

integrated into a wide range of electronic devices. They work by radiating energy from a metallic patch (or “patch”) that is suspended above a dielectric substrate.

The patch is connected to a feed line, which provides the energy that is radiated by the antenna. The operating frequency bands can be achieved by adjusting the size, shape, and dielectric constant of the substrate material. In recent years, wireless communication technology has developed rapidly, and as a result, WLAN communication systems have also seen significant growth and an expanding range of applications in the market .

Wireless communication systems require quick, efficient, and dependable two-way data transmission, which is reflected in the design of their antenna subsystem. The antenna plays a vital role in such systems .

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LITERATURE SURVEY

[1] P. Rani, B. C. Sahoo, G. Singh, A. Kumar and A. P. Singh, "On the Design of Slotted Linear Patch Antenna Array for Wireless Communication"Recognizing the critical role antenna design plays in wireless communication, a research paper by P. Rani et al. investigates a slotted linear patch antenna array. This study explores the potential benefits of incorporating slots into a traditional linear patch antenna design.

[2] A. S. Prabowo, N. Pambudiyatno, and B. B. Harianto, “Microstrip Antenna Design withPatch Rectanguler for Primary Surveillance Radar (PSR) L-Band Application” A research paper by A. S. Prabowo et al., titled "Microstrip Antenna Design with Patch Rectanguler for Primary Surveillance Radar (PSR) L-Band Application", tackles antenna design for radar applications.

[3] K. Mahendran, D. R. Gayathri, and H. Sudarsan, “Design of multi band triangular microstrip patch antenna with triangular split ring resonator for S band, C band and X band applications” "Microstrip Antenna Design with Patch Rectanguler for Primary Surveillance Radar (PSR) L-Band Application" by A. S. Prabowo et al., focuses on antenna design for radar applications.

[4]P. S. Naik and H. G. Virani, "1×4 Microstrip Patch Slotted Array Antenna for 5G C Band Access Point Application" The field of radio wave technology is constantly innovating to improve antenna design for both radar and wireless communication systems. In radar technology, research by A.S. Prabowo et al. focuses on microstrip antennas with rectangular patches for primary surveillance radars (PSRs) operating in the L-band.

[5] Md Ziaur Rahman, Mohammed Mynuddin, Kartik Chandra Debnath,“The significance of Notch Width on the performance of Inset Feed Rectangular Microstrip Patch Antenna” The paper "The significance of Notch Width on the performance of Inset Feed Rectangular Microstrip Patch Antenna" delves into the crucial role played by the width of a notch in influencing the performance of antennas with inset feed, particularly rectangular microstrip patch antennas.

PROPOSED SYSTEM

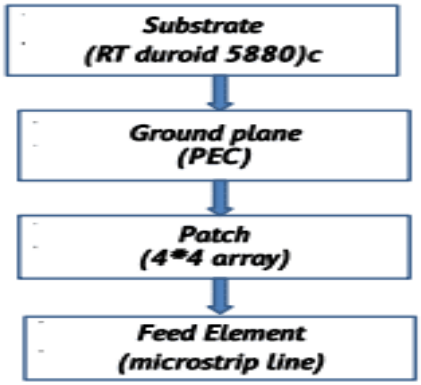

Fig: Block Diagram

- 4×4 Arrays can be used to achieve higher gain and achieve better VSWR, return loss.
- It increases communication reliability to cancel interference from specific directions, to steer the radio beam electronically to point in different directions.
- RT duroid 5880 is used as substrate material

EXPERIMENTAL RESULTS

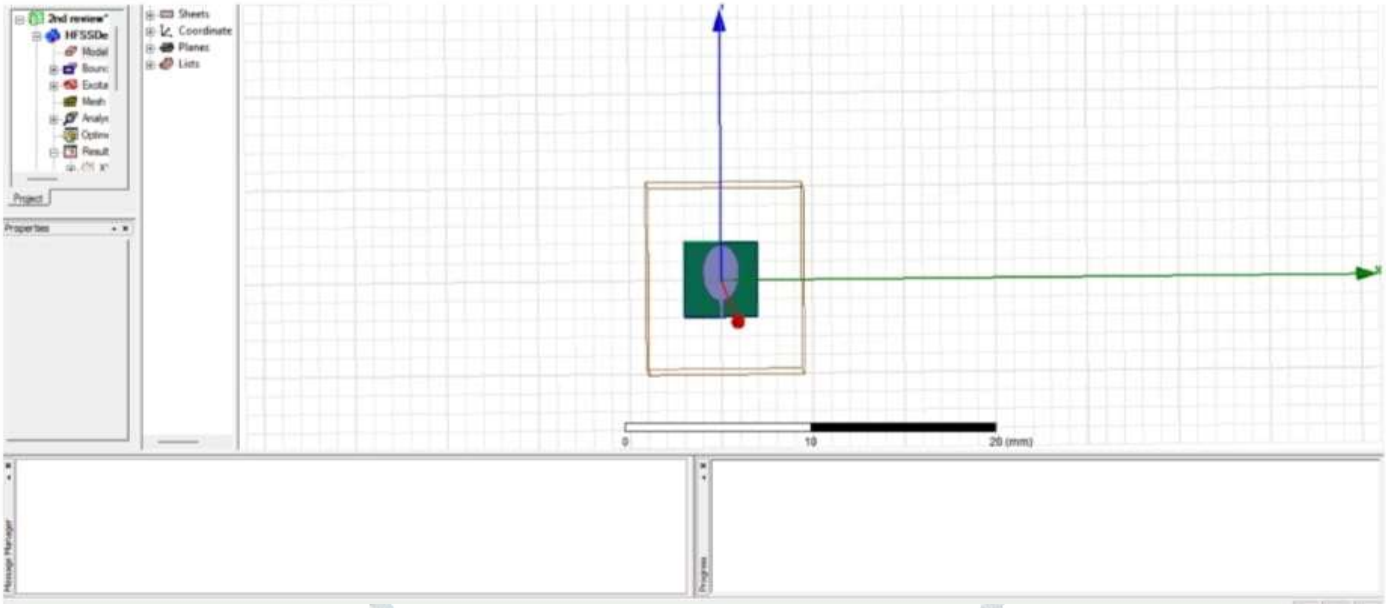

Fig: Designing of 4*4 array microstrip patch antenna

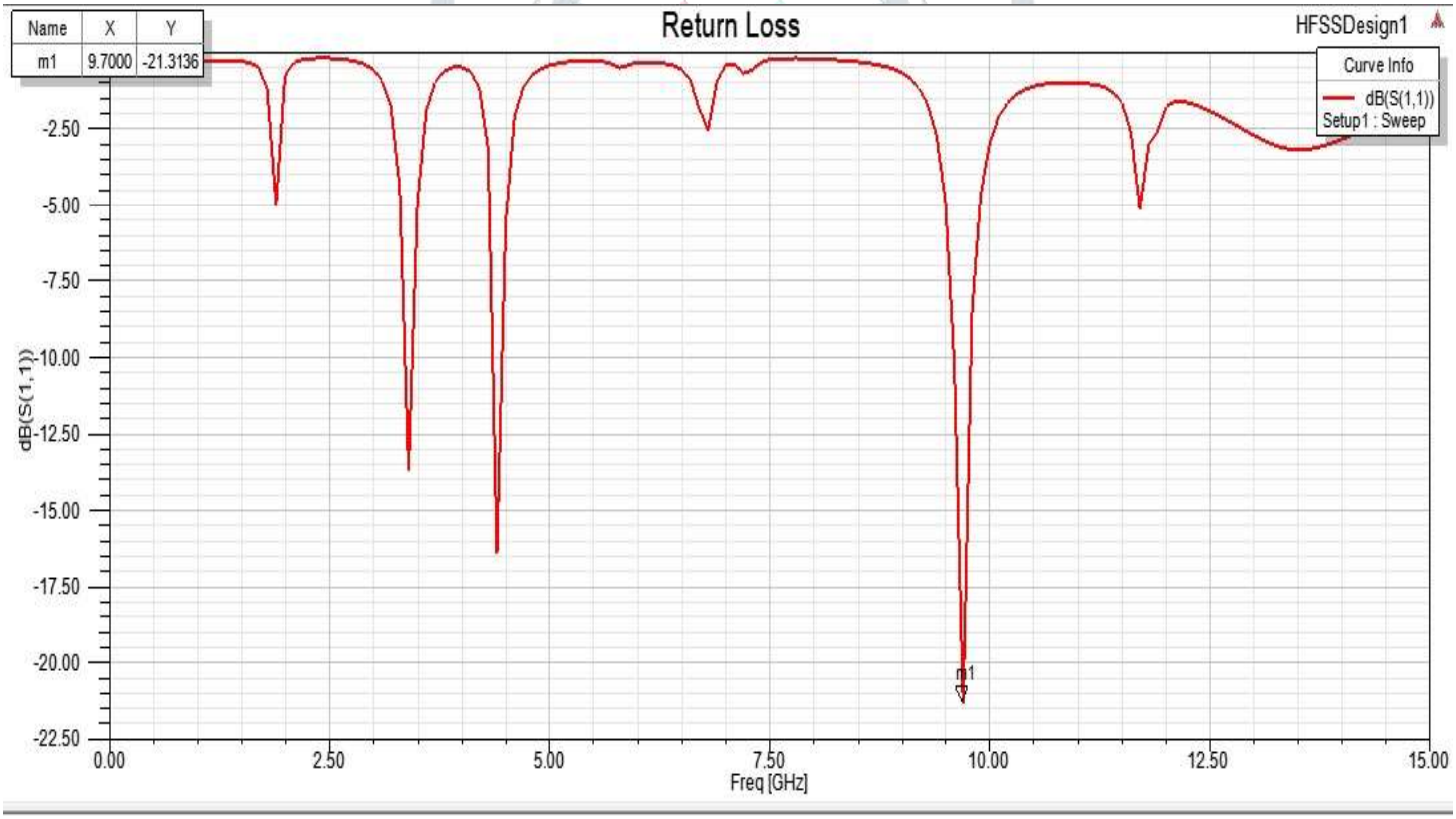

Fig: Simulation results

This paper presents a detailed analysis of a 4x4 microstrip patch array antenna designed using HFSS 15.0 software for satellite communication applications. The antenna's performance metrics, including return loss (-21.313 dB), Voltage Standing Wave Ratio (VSWR), and gain (9.4 dB), are evaluated in depth.

CONCLUSION:

Research findings have demonstrated that a 4x4 array design offers notable advantages over a 2x2 array configuration, particularly in the context of satellite communication systems. These advantages stem from a combination of factors that collectively contribute to enhanced performance and functionality.

One of the primary advantages of a 4x4 array is its increased data handling capability. Compared to a 2x2 array, a 4x4 configuration can process and transmit a higher volume of data simultaneously. This heightened throughput is crucial in today's communication networks, where data demands continue to escalate due to evolving technologies and increasing user expectations.

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