International Journal Of Advance Research, Ideas And Innovations In Technology

ISSN: 2454-132X
Impact factor: 6.078
(Volume 6, Issue 3)
Available online at: www.ijariit.com

Beam steering antenna array for multiband applications

K. Pratheesha
pratheeshakanishk@gmail.com
Panimalar Institute of Technology, Chennai, Tamil Nadu

G. V. Srividhya
vidhyavenkataramanan@gmail.com
Panimalar Institute of Technology, Chennai, Tamil Nadu

D. Kalaiarasi
kalai05art@gmail.com
Panimalar Institute of Technology, Chennai, Tamil Nadu

ABSTRACT

A beam steering is mainly used in the Near field communication (NFC) devices and radio communication system. Beam steering is the process of changing the direction of the main lobe of the radiation pattern which is done by switching antenna components or by changing the phase of the signal. Low loss phase shifters can be used to perform beam steering, by which the direction of main lobe can be controlled at THZ . The switched line phase shifters are the commonly used one which is designed by using 2 transmission lines are reference line and delay line. Cater to these needs by radiating at specific discrete frequencies only. Beam steering is the process of changing the direction of the main lobe of the radiation pattern. In acoustics, this technique is used to direct the audio from loud speakers to a specific location in the listening area. This can be done by changing the magnitude and phase of two or more loud speakers arranged in a column called as line array. It is also used in the applications of ray optics such as Galvanometer. A multiband fractal antenna loaded with a dielectric resonator conforming to multiple wireless standards is presented in this

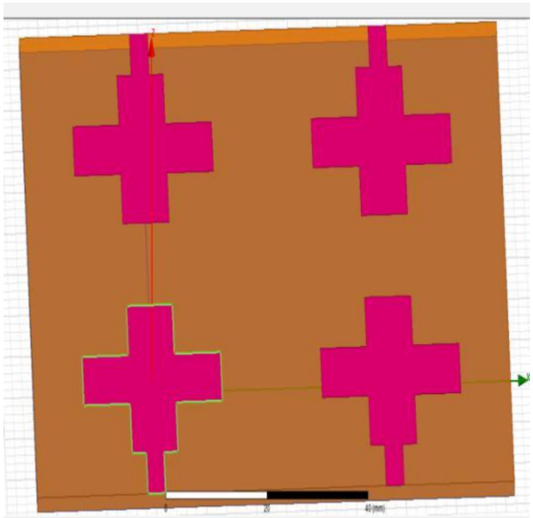
Keywords— *Microstrip patch antenna, antenna array, Beam steering, multiband frequency*

1. INTRODUCTION

Today's mobile communication systems demand increased bandwidth for voice and data applications. Multiband antennas project. Fractals are never ending, infinitely complex patterns that reduces the overall size of the antenna design. The design is used for varying frequency range. The fractal design has the advantage of reducing the size and can produce multiple resonant band with increased intensity.

2. ANTENNA DESIGN

In this project, we will discuss the antenna design process. First, we decide the patch antenna material. FR4 Epoxy printed circuit board is chosen to design this 2X2 polarization patch antenna array because this material offers the high frequency performance and low-cost circuit fabrication. The dielectric constant 4.4. Then, the antenna is constructed by driven patch and parasitic patch. Fr4 is chosen for both the driven and parasitic boards, which are separated with a spacing of 7mm.



The driven patch is printed on the top surface of the driven board and the parasitic patch is printed on the bottom surface of the parasitic board. Finally, the goal of this antenna design is to perform radiation direction in +Z direction, and the reflection coefficient of each part should be less.

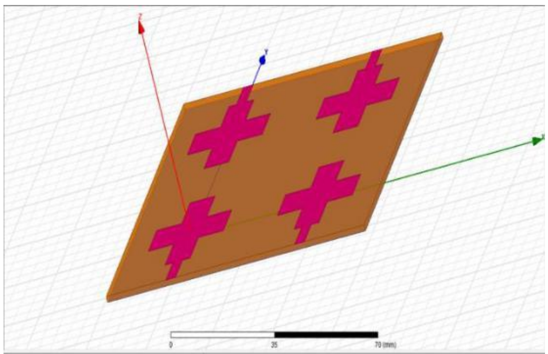


Fig 1: Patch Antenna array

3. HARDWARE DESCRIPTION

The patch is made up of copper. Copper is an excellent electrical conductor. Most of its uses are supported this property or the fact that it is also a thermal conductor. The substrate is made up of FR4. FR-4 (or FR4) may be a grade designation assigned to glass-reinforced epoxy laminate sheets, tubes, rods and printed circuit boards (PCB). FR-4 is a composite material composed of woven fiber glass cloth with an epoxy resin binder that is flame resistant (*self-extinguishing*). "FR" stands for Flame Retardant, and denotes that safety of flammability of FR-4 is in compliance with the standard UL94V-0. FR-4 was created from the constituent materials (epoxy resin, woven glass, fabric reinforcement, brominated flame retardant, etc).

The dielectric load is used for enhancing the impedance bandwidth of the antenna at the upper frequency band as well as improving the overall gain of the antenna. The current distribution is excited upon the corner of the antenna. The fractal design is made by cutting, bending and etching of the antenna corners, radiation pattern and reflection coefficient is analysed on the antenna.

Design is done over the patch with base of dielectric substrate. A dielectric substrate again placed over the antenna patch which leads to multiband system.

4. SIMULATION RESULTS

The beam steering is obtained by the 4 patches that are arranged in the form of an array. The two patches are given one feed for providing input and the other two patches are provided with a set of feed to give the input.

The total beam steering obtained is 90 degrees. The graphical representation gives the S-parameter reading of port 1.

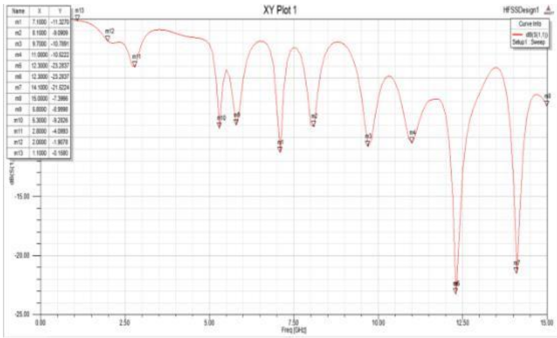


Fig. 2: simulated results of s-parameter

Similarly, simulated results can be obtained for the port 2 and also for both the ports 1 and 2.

4.1. Return loss

The amount of power absorbed by load or it can also be defined as the loss of power in the signal reflected by a discontinuity in a transmission line. From the graph, for the frequency of 12.3 GHz, the return loss obtained is -23.28 db**.** For the frequency of 14.2 GHz, the insertion loss obtained is -22 db.

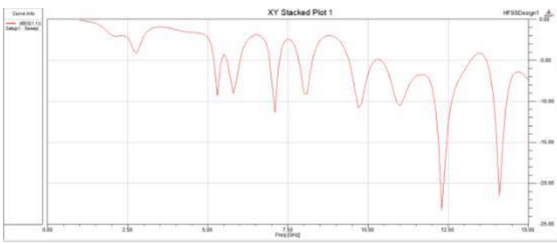


Fig. 3: simulated result of return loss

Thus, by varying the frequency, different radiation patterns can be obtained from which the values of gain, directivity, VSWR, return loss can be calculated.

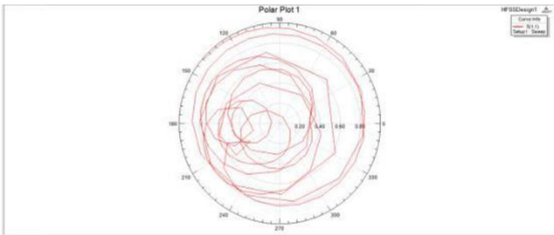


Fig. 4: polar representation of return loss

4.2 Radiation Pattern

An antenna radiation pattern is defined as a mathematical function or graphical representation of radiation properties of antenna as a function of space co-ordinates.

Fig. 5: 3D Radiation pattern

4.3 Gain

Gain is the ratio of maximum radiation intensity from subject antenna to maximum radiation intensity from reference antenna with same input power. The value of VSWR obtained is 0.28.

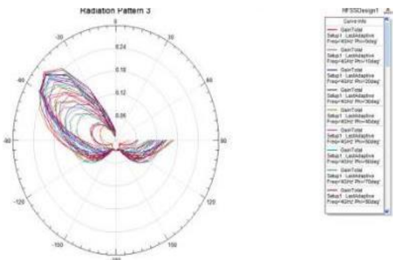


Fig. 6: simulation result of gain

4.4 VSWR

It is the ratio between transmitted and reflected waves. The increase in VSWR can decrease the efficiency. It can also be obtained from the radiation pattern of the antenna.

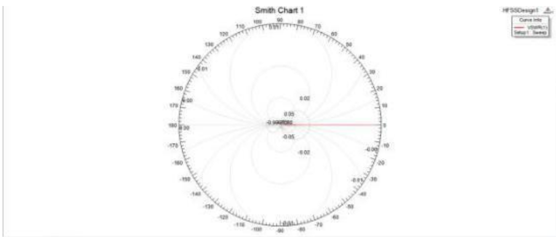


Fig. 7: simulation result for VSWR

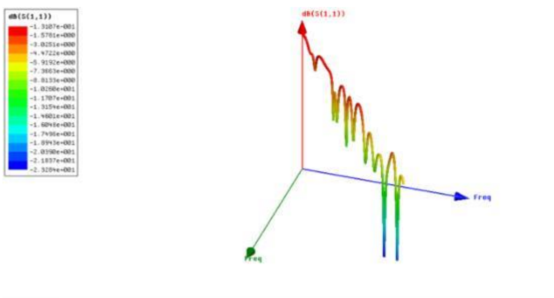


Fig. 8: 3D radiation pattern with return loss

Tabulation:

Dimensions	Length	Width
Substrate	95.66 mm	112.16 mm
Patch	27.83 mm	36.08 mm
Ground	95.66 mm	112.16 mm

A microstrip patch antenna is constructed to calculate the radiation pattern, gain, directivity and VSWR. During this project we are employing a FR4 substrate with dielectric constant 4.4. It is a flame-retardant substrate. The FR4 becomes very stable at high frequencies above 1GHz. The substrate selected here is made with position Radius X= 95.66mm, Y= 112.16mm, and thickness= 1.6mm.

A rectangular patch antenna is meant and studied using various feeding techniques. The rectangular patch is far and away the foremost widely used configuration. The power efficiency, bandwidth and impedance will affect the width of microstrip antenna and also width depends upon the operating frequency and substrate dielectric constant. The dimensions of patch antenna are with position X-size=27.83 mm and Y-size= 36.08 mm. The power efficiency, bandwidth and impedance will affect the width of microstrip antenna and also width depends upon the operating frequency and substrate dielectric constant. The dimensions of ground of the patch antenna are with position X-size= 95.66 mm and Y-size= 112.16 mm.

5. CONCLUSION

In the existing system, graphene is used to produce THz frequency for 2 patches. The major disadvantage of graphene is that it is too expensive. It is used only for single band applications. The proposed system consist of 4 patches that are used for multiband applications that can be operated at GHz frequency range. The THz frequency cannot be used for real time applications and hence for real time applications, GHz frequency is used.

6. REFERENCES

[1] H. Errifi, A. Baghdad, A. Badri and A. Sahel," Electronically Reconfigurable Beam-Steering Array Antenna using Switched Line Phase Shifter International Conference on Wireless Networks and Mobile Communications, 20017.

[2] A. Castro Neto, F. Guinea, N. Peres, K. Novoselov, and A. Geim, "The electronic properties of graphene," Reviews of Modern Physics, vol. 81, no. 1, pp. 109–162, 2009.

[3] G. W. Hanson," Dyadic greens functions and guided surface waves for a surface conductivity model of graphene", Journal of Applied Physics, vol. 103, 064302, 2008.

[4] A.Balanis, Antenna Theory, 2nd. Edition ed. Arizona StateUniversity: John Wiley & Sons,Inc, 1997.

[5] I. Rexiline Sheeba, T. Jayanthy "Mobile Application SAR Analysis in Human head model using a Dual frequency triple slotted patch, inset feed, flexible soft wear antenna" , International Journal of Engineering & Technology, Vol 07, PP: 704-710 http://dx.doi.org/10.14419/ijet.v7i3.20.22977,2018

[6] I.Rexline Sheeba, T.Jayanthy "Design and implementation of flexible wearable antenna on thyroid gland in the detection of cancer cells", Biomedical Research,Vol 29, Issue 11, PP:2307-2312,April 2018.

[7] D. M. Pozar, Microwave Engineering, 2nd Ed. Newyork: Wiley, 1998.

[8] L. Magthelin Therase, Dr. T. Jayanthy "Metamterial loaded circular ring microstrip antenna with CSRR as ground plane for 5G applications", International Journal of Engineering & Technology,Vol 07, Issue 04, PP: 3978-3983, 2018.

[9] Deborah sabhan, Victor Jaya Nesamoni, T.Jayanthy "A Wide-beam, circularly polarized, three staged, stepped impedance, spiral antenna for direct matching to rectifier circuits", Review of Scientific Instruments, Vol: 90, Issue: 5, DOI: 10.1063/1.5088572,2019.

