Microstrip Patch Antenna with Periodic Structure

Bhalerao Varsha, Bochare Anuja, Dhavale Aishwarya

Abstract— **In today's communication system antenna are the most important component for creating communication link. Microstrip antenna is very useful in mobile application and other application because of their weight and low power handling capacity. Microstrip patch antennas have number of advantages like low profile, broadside radiation, low cost, low weight and conformability. In this paper we uses microstrip patch antenna with center frequency at 2.4GHz and design periodic structure operated in the frequency range at 2.4GHz to implement the application of EBG (Electromagnetic band-gap)structure on antenna. At particular frequencies, they provide a zero degree phase shift for reflected plan waves and effective acts as high impedance surface. The periodic structure are now more attracting more attention form academia and industrial as High Impedance Surface(HIS) or Artificial Magnetic Conductor(AMC) reflector.**

Index Terms—**Electromagnetic Band Gap (EBG), Microstrip Patch Antenna, Artificial Magnetic Conductor (AMC).**

I. INTRODUCTION

A conductor by which electromagnetic waves are sent out or received, consisting commonly of a wire or set of wire.[1]A microstrip patch antenna are widely used in communication device due to its small size, thin profile configurations, low cost and conformity. In this paper, the effect of the characteristics of a patch antenna(gain, bandwidth, and radiation pattern)especially on loss return, by using two different feeding points. If we increases the thickness of substrate or use the substrates with high dielectric constant, we can limit the propagation of surface waves.[2]

A conducting strip is connected to the edge of the microstrip patch. The conducting strip is smaller in width as compared to the patch.[3]Conductivity of microstrip transmission line and ground plane is very high (typically copper) The another name for .microstrip antenna is "patch antenna" One of the most useful antennas at microwave frequencies(f> 1GHz).It usually consists of a metal "patch" on top of a grounded dielectric substrate .The patch may be in a variety of shapes, but rectangular and circular are the most common[4].

Microstrip patch antenna is consist of substrate between a ground plan and patch. The surface waves reduce the antenna efficiency and gain. We are using HFSS(High Frequency Simulator) software[6].

HFSS is the one of the important software tool use for antenna design and design of complex RF electronic circuit element such as filter transmission line and packaging. In microstrip patch antenna with periodic structure to reduce the surface wave propagation[7].

The electromagnetic band gap structures are periodic rod or hole type structure that provide extremely sharp rejection and minimum transmission of power over the band of frequency [5].

II. DIAGRAM

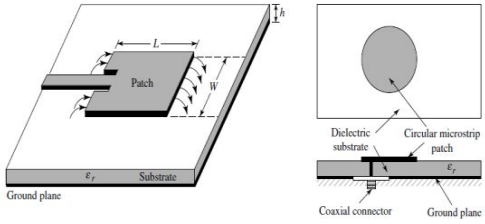


Fig 1:Structure of microstrip patch antenna

The primary goal of microstrip patch antenna is to determine the substrate and patch dimensions necessary to design the antenna over the specific frequency band. There are different types of patch are generally used like square, reactangular, circular, triangular and elliptical. The dielectric constant of the substrate Єr is typically in the range 2.2<Єr<12.for good antenna performance a thick dielectric substrate have low dielectric constant hence it provide better efficiency and good bandwidth.

III. DESIGN

Frequency	2.4Ghz
Shape of patch	Rectangular
Feeding method	Microstrip line feeding
Height substrate	1.6mm
Dielectric constant	4.4

A. Theoretical Design

Step 1: calculation of width:
Width of antenna is given by

$$W = \frac{C}{2f_r\sqrt{\left(\frac{\varepsilon_r + 1}{2}\right)}}$$

Where;

C-free space velocity of the light =$3*10^{8m/s}$

fr-Frequency of operation

ϵr - Dielectric constant

Step 2: Calculation of Effective dielectric constant (ε_{reff}):
The effective dielectric constant is given by

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left\{1 + 12\frac{h}{W}\right\}^{-1/2}$$

Where;

ε_r – dielectric constant
h-height of dielectric substrate
W-width of patch

Step 3: calculation of effective length (L_{eff}):
The effective length is given by

$$L_{eff} = \frac{C}{2f_r\sqrt{\varepsilon_{reff}}}$$

Where;

c – free space velocity of the light=3 x 10^8 m/s
f_r – frequency of operation
ε_{reff} – effective dielectric constant

Step 4: calculation of actual length of patch (L):
The actual length is given by

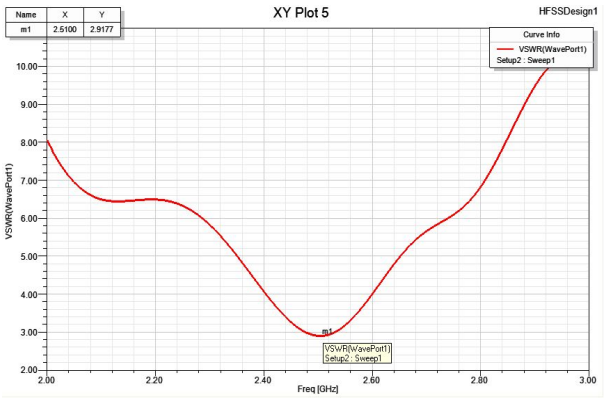
$L=L_{eff}-2\Delta L$

Where,

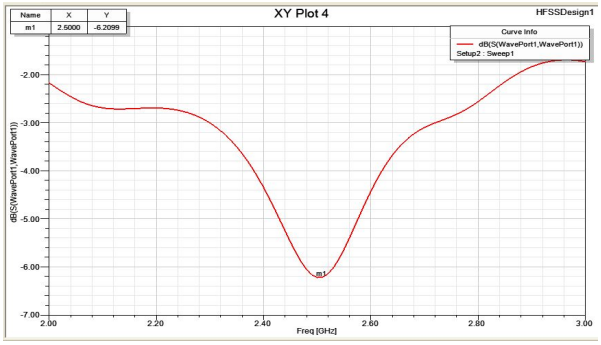
L-actual length of patch
L_{eff} –effective length
ΔL-small difference between length

IV. SIMULATION RESULT

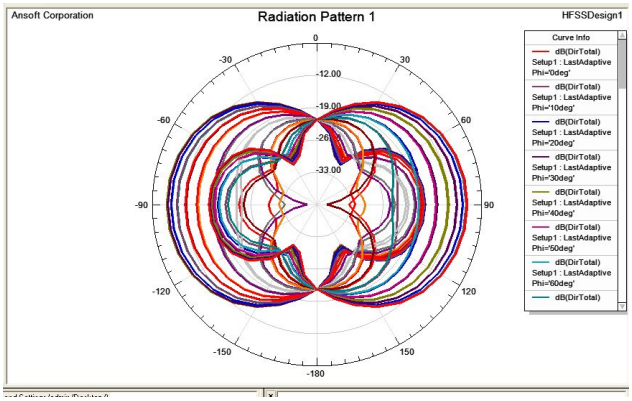
1) VSWR Result



2) Return loss



3) Radiation pattern



V. APPLICATION

Microstrip patch antenna is used in mobile satellite communication. It is also used in wireless LAN,GPS system. Microstrip patch antenna is use in direct broadcast television. It is use in Bluetooth application.

VI. CONCLUSION

We will propose microstrip patch antenna with periodic structure to reduce the surface wave propagation. By reducing surface wave we can able to improve the antenna parameter. The designing of microstrip patch antenna with HFSS software is completed.

VII. ACKNOWLEDGMENT

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