

Survey on Different types of reconfigurable Patch Antenna for Wireless Applications

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Abstract — With the rapid advancement in wireless communication, reconfigurable antenna is gaining greater attention. Reconfigurable antenna have more advantages when compared with the conventional antenna. Reconfigurable antenna provide diversity feature of frequency, polarization and radiation pattern which is used in various applications. To achieve high bandwidth and high gain in wireless applications, reconfigurable Microstrip patch antennas are used. Different reconfigurable Microstrip patch antennas are analyzed and summarized in this paper.

Keywords — Microstrip patch antenna, Reconfigurable antenna

I. INTRODUCTION

Microstrip patch antennas are printed directly onto a circuit board it becoming more useful. It is more popular due to its compact size, low cost, light weight, etc. It has an inherent characteristics such as light weight, low Profile, low cost, mechanically robust, compatibility with Integrated circuits and very versatile in terms of resonance Frequency. . Microstrip antenna has high bandwidth and gain.[5]. In high performance aircraft, spacecraft, satellite, and missile applications, microstrip antennas are widely used. Presently there are many other government and commercial applications such as mobile, radio and wireless communications where microstrip patch antennas are being given preference.

A. Reconfigurable antenna

Reconfigurable antenna is an antenna which is capable of reconfiguring its characteristics such as frequency, radiation pattern and polarization to adapt the environment. In recent years the reconfigurable antennas are attaining great attention especially in wireless communication systems due to its ability to reduce front end system and also allow pre-filtering at the receiver side. The reconfigurable antennas also contain many other features like low cost, multipurpose functions, and size miniaturization. Microstrip antenna has been used as a platform to design reconfigurable antenna. The requirement of increase bandwidth, gain performance can be achieved by reconfigurable antenna. The basic working principle of this reconfigurable antenna is achieved by switching the status of an RF switch (ON or OFF mode) affects the current distribution of the antenna. Switching components such as PIN diodes, varactor diodes, MEMs switches, and optoelectronic switches are normally used to achieve reconfigurable antenna.

B. Reconfiguration

Reconfiguration of antenna has classified into four categories.

Frequency reconfiguration– change of frequency ant different band. By tuning the RF current in the circuit, reconfiguration is done.[5]

Polarization reconfiguration - Radiating structure that can change its Polarization like horizontal polarization, vertical polarization, left hand and right hand side polarization. [4]

Radiation pattern reconfiguration - Radiating structure able to tune radiating pattern that is called Radiation Pattern reconfiguration.[5]

Gain reconfiguration Radiating Structure able to enhance the gain called Gain RA.

II. SWITCHING COMPONENTS

PIN Diodes – basic switching components used to alter the RF current flow in the circuit. It has the advantages that low cost, easy to fabricate, fast switching response, and reliable. PIN diode has only one drawback that it has high DC bias current. A detailed discussion about various configurability and survey of various reconfigurable antennas are discussed in the upcoming sections of the paper.

Varactor Diodes – it has the advantage that the current flow through varactor diode is small when compared to PIN diode. The drawback is that varactor diodes are nonlinear and low dynamic range.

MEMs – it has a greater advantage that low power loss and insertion loss. The drawback is that slow switching speed and has complex fabrication.

III. SURVEY ON RECONFIGURABLE ANTENNA

1. *Pattern reconfigurable microstrip patch antenna using MEMS.*

The antenna constructed by a rectangle patch and two U shape patches. This can be connected with RF MEMS and radiated with four patterns as shown in figure 2. The four patterns have operated at same frequency and used with radar and satellite. The switch is used to change the states of antenna, metal strips and air gaps are used rather than OFF and ON switches. In this antenna four directions are redirect with same frequency and coverage ranges of E and H plane. [8]

2. *Frequency Reconfigurable Microstrip patch antenna using PIN Diode*

The frequency reconfigurable patch antenna using passive component like PIN diode that help to achieve frequency reconfiguration. PIN diode is placed at feed line. In addition, when passive components are switched ON than achieved one frequency and when switched OFF than achieved another frequency. So using this method achieves the different frequency on single antenna using PIN diode. [6]

3. *Frequency reconfigurable microstrip rectangular patch antenna Using stubs*

The frequency reconfigurable microstrip antenna is connected to a feed line and two electronic switches. The design used with stubs are open, shorted and balanced stubs (three stubs). It attains with good Omni directional radiation. The antenna based on FR4 epoxy substrate with rectangular patched by a micro strip line. In the three types of stubs open stubs are not resulting with fully omni directional pattern, shorted stubs improved with radiation omni directional, and balanced stubs are attain with better omni directional pattern with balanced stubs and also the feed line are increased with electronic switches.

4. *Frequency reconfigurable micro strip antennas using VARACTOR diodes*

The design of a compact, single feed, dual polarized and electronically reconfigurable micro strip antenna are evaluated with the dual frequency. The dual frequencies are extended with arms of hexagonal slot. The slots are integrated with varactor diode to tune the frequency. The processes are applied with reverse bias. Hexagonal slot are exited with two distinct resonant modes of orthogonal polarization planes. That polarization is operated with dual frequency. Then the resonant mode are standard with micro strip feed line increase the resonant mode of dual frequency passive antenna. It also increases the size reduction of antenna. It attains with high frequency, gain, directivity and bandwidth.

IV. APPLICATIONS

A. *Pattern Reconfigurable Antenna for MIMO System*

MIMO systems are work as transmitter and receiver means multiple inputs and multiple outputs. The use of such type of antennas increases significantly the capacity by allowing the selection between different pattern and polarization configurations. Reconfigurable antenna arrays are the best solution for MIMO systems to maintain good communication links.

B. *Reconfigurable monopole antennas for WLAN\WIMAX application*

A simple reconfigurable monopole antenna with application of WLAN\WIMAX. The antenna compared with three patch strips triple band monopole antennas operate with different frequency. Then the frequency are established using the software studio and fabricated on FR4 epoxy substrate. Antenna comprise with copper strip that are contribute to three resonance frequency. Copper strip are design with quarter wavelength of operating frequency. The triple band o strip antennas are connected with two switches of ON and OFF state that are ignored with reconfigurable antenna. The characteristics of antenna are required with application triple band frequency that are simulated and increase with return loss, low profile, compact, small size and good performance of application bands. [1]

C. *Frequency Reconfigurable Antenna for a Cognitive Radio Application*

A cognitive radio system used to communicate efficiently across a channel by altering its frequency of operation based on the constant monitoring of the spectrum. This system is able to continuously monitor gaps in the finite frequency spectrum occupied by other wireless systems, and then dynamically alter its transmit/receive characteristics to operate within these unused frequency bands, thereby minimizing interference with other wireless systems and maximizing throughput. So solve this problem used reconfigurable. And frequency reconfigurable achieved by patch antenna within switching. [5][2]

D. *Reconfigurable Antennas for Satellite Applications*

The need for dynamic space applications has use of reconfigurable antennas for satellite communication. In this system, it is necessary to reconfigure the antenna radiation pattern to give out a new coverage zone, limit fading in rainy areas, and maintain high data rate at all possible frequency bands of operation elements. So achieved the frequency tuning which is suitable for cognitive radio applications. [7][3]

V. CONCLUSION

Different reconfigurable antennas are used in various wireless applications such as cognitive radio, space, satellite communication and mobile radio etc. Here different reconfiguration techniques are studied and explained different antennas for

different applications. Reconfigurable antennas are more efficient than all other antenna techniques because single antenna can be operated with different modes. It is suitable for single antenna with multi-use applications or users to use. It provides more efficient communication with minimum cost.

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