A Review on Reconfigurable Communicating Patch Antenna

[1]Kanak singh, [2]Manoj Kumar Gautam, [3]Swatantra Tiwari

***Abstract*: This paper presents a microstrip wideband antenna and its utilization in integration of multiple wireless communication systems. A simple fork-like strip antenna, fed by a coplanar-waveguide (CPW) transmission line. Due to shortage of fabrication utilities; both simulation methods results are in agreement with the design principles. This reconfigurable multi-band new-shaped patch antenna can be applied to any desired frequency band used for communication or satellite applications.**

***Keywords*: Microstrip wideband antenna, fork-like strip antenna, CPW**

Introduction

In now day's the wireless system has become a part of human life. Most of the electrical and electronics equipment around are using the wireless system. An antenna is an essential element of the wireless system. Antenna is an electrical device which transmits the electromagnetic waves into the space by converting the electric power given at the input into the radio waves and at the receiver side the antenna intercepts these radio waves and converts them back into the electrical power. There are so many systems that uses antenna such as remote controlled television, cellular phones, satellite communications, spacecraft, radars, wireless phones and wireless computer networks. Day by day new wireless devices are introducing which increasing1 demands of compact antennas. Increase in the satellite communication and use of antennas in the aircraft and spacecraft has also increased the demands a low profile antenna that can provide a reliable communication.

A microstrip antenna is one who offers low profile and light weight. It is a wide beam narrowband antenna can be manufactured easily by the printed circuit technology such as a metallic layers in a particular shape is bonded on a dielectric substrate which forms a radiating element and another continuous metallic layer on the other side of substrate as ground plane not only the basic shapes any continuous shape can be used as the radiating patch. Instead of using dielectric substrate some of the microstrip antennas use dielectric spacers which results in wider bandwidth but in the cost of less ruggedness. Microstrip antennas are low profile antenna and mechanical rugged and can be easily mounted on any planar and nonplanar surfaces. The size of microstrip antenna is related to the wavelength of operation generally $\lambda/2$. The applications of microstrip antennas are above the microwave frequency because below these frequencies the use of microstrip antenna doesn't make a sense because of the size of antenna. At frequencies lower than microwave, microstrip patches don't make sense because of the sizes required. Now a day's microstrip antenna is used in commercial sectors due to its inexpensiveness and easy to manufacture benefit by advanced printed circuit technology. Due to the development and ongoing research in the area of microstrip antenna it is expected that in future after some time most of the conventional antenna will be replaced by microstrip antenna.

1.2 Types of antenna reconfiguration

Re-configurable antennas can be classified according to the antenna parameter that is dynamically adjusted, typically thefrequency of operation,radiation patternorpolarization(Huff and Bernhard, 2008).

- Frequency reconfiguration
- Radiation pattern reconfiguration.
- Polarization reconfiguration.
- Compound reconfiguration.

1.2.1 Frequency reconfiguration

Frequency reconfigurable antennas can adjust dynamically theirfrequency of operation. They are particularly useful in situations where several communications systems converge because the multiple antennas required can be replaced by a single reconfigurable antenna. Frequency reconfiguration is generally achieved by modifying physically or electrically the antenna dimensions using RF-switches, (Panagamuwa, Chauraya, and Vardaxoglou. 2006). Impedance loading (Erbil, Tonally, Ulna, Civil, and Akin, 2007). Or tunable materials (Liu, and Langley, 2008).

1.2.2 Radiation pattern reconfiguration

Radiation pattern reconfigurability is based on the intentional modification of the spherical distribution ofradiation pattern.Beam steeringis the most extended application and consists in steering the direction of maximum radiation to maximize the antenna gain in a link with mobile devices. Pattern reconfigurable antennas are usually designed using movable/rotatable structures (Rodrigo, Joffre, and Center, 2012). Or including switchable and reactively loadedparasiticelements (Aboufoul, Parini, Chen, and Alomainy, 2013).

1.2.3 Polarization reconfiguration

Polarization reconfigurable antennas are capable of switching between differentpolarizationsmodes. The capability of switching between horizontal, vertical and circular polarizations can be used to reduce polarization mismatch losses in portable devices. Polarization re-configurability can be provided by changing the balance between the different modes of a multimode structure (Simons, Donghoon, and Katehi, 2002).

1.2.4 Compound reconfiguration

Compound reconfiguration is the capability of simultaneously tuning several antenna parameters, for instance frequency and radiation pattern. The most common application of compound reconfiguration is the combination of frequency agility and beam scanning to provide improved spectral efficiencies. Compound configurability is achieved by combining in the same structure different single- parameter reconfiguration techniques (Aboufoul ,Chen,Parini, and Alomainy, 2014)

1.3 Advantages and Disadvantages of reconfigurable antenna

The advantages are significant:

- Have a multiband antenna in a single terminal for various applications.
- Easy to integrate with switching devices and control circuit.
- Small in size.
- Can easily design antenna with desired polarization.
- Mechanically robust, Resistant against vibration and shock.

However, the design of reconfigurable antenna are typically driven by the balance of trade-offs. Compared with fixed-tuned antenna, due to its short developing time, there are still some disadvantages waiting to be solved:

- The technology of reconfigurable relies largely on RF switch technology, which is not mature enough yet.
- Increased complexity and cost to the mobile phone.
- Reduced Efficiency.
- Low gain and power handling capability.
- Sensitive to environment conditions like temperature and humidity.

2. Literature Survey

W. S. Yeoh, K. L .Wong and W. S. T. Rowe (2011), have used linearily polarized miniaturized printed dipole antenna with novel half bowtie radiating arm is presented for wireless application including 24GHz ISM band. An integrated balun with inductive transition is employed for wideband impedencematching without changing the geometry of radiating arms. Here, the author is compare the size and performance of miniaturized half bowtie dipole antenna with similar reduced size antennas with respect to their overall footprint, substrate, dielectric constant, frequency of operation and impedence bandwidth.

X. Li. Yang, S. X. Gang and Y. J. Yang (2009), have defined a dual band printed dipole antenna with integrated balun feed. First, he represented a fork shaped slot is etched on the arms of the printed dipole antenna to achieve the dual band operation with resonance at WLAN bands. In order to get larger bandwidth, a modified Marchandbalun is introduced for dual band operation, which can provide to resonancein each band to enhance the impedence bandwidth.

Z. G. Fan, S. Qiao, J. T. Huangfu, and L. X. Ran (2007), have proposed a miniaturized printed dipole antenna with V-shaped ground is proposed for radio frequency identification (RFID) readers operating at the frequency of 2.45GHz. Though extending and shaping the ground to reduce the coupling between the balun and the dipole the antennas impedencebandwidth is broadened and radiation pattern is improved. The 3D finite difference time domain (FDTD) Electromagnetic stimulation are carried out to evaluate antennas performance. The result shows that proposed antenna achieves a broader impedence bandwidth, a higher forward radiation gain and stronger suppression to backward radiation compared with the one without such a ground.

Yun-Wen Chi, Kin Lu Wong, and Saou Wen Su (2007), have proposed a dipole antenna capable of generating a wide operating band for digital television signal reception in 470-806 MHz. The antenna is rectangular shape and comprises two symmetric radiating portion of arm1 and arm2 separated by step shaped feed gap. The antenna can generate two adjacent resonant modes to form operating band.

Conclusion

In this paper, review the reconfigurable microstrip patch antenna and explained. This reconfigurable multi-band new-shaped patch antenna can be applied to any desired frequency band used for communication or radio applications. All the research work done in this area are clearly shows that reconfigurable microstrip patch antennas are compact and cheaper. They have also good performance.

References

[1] Mohamed Nasrun OSMAN, Mohamad Kamal A. RAHIM, Peter GARDNER, "An Electronically Reconfigurable Patch Antenna Design for Polarization Diversity with FixedResonant Frequency", RADIOENGINEERING, VOL. 24, NO. 1, APRIL 2015.

[2] Prashant Chandra Bhardwaj, Ashok Kumar Kajla, Rahul Raj Choudhary, "Design a Reconfigurable Patch Antenna for Mobile Application", Matrix Academic International Online Journal Of Engineering And Technology, Volume 3, Issue 2, pp: 21-26, 2016.

[3] E.Ramola, T.Pearson, "Reconfigurable Microstrip Patch Antenna using MEMS Technology", IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), Volume 4, Issue 4, PP 44-51, Jan. - Feb. 2013.

[4] Haydar M. Al-Tamimi, Salah Mahdi, "A Study of Reconfigurable Multiband Antenna for Wireless Application", International Journal of New Technology and Research (IJNTR), Volume-2, Issue-5, Pp: 125-134, May 2016.

[5] Ibrahim Tekin, Michael Knox, "Reconfigurable microstrip patch antenna for WLAN Software Defined Radio applications", Wiley Periodicals, Vol. 54, No. 3,PP: 644-650, March 2012.

[6] Pazin, L., &Leviatan, Y. (2013). Reconfigurable slot antenna for switchable multiband operation in a wide frequency range. *IEEE Antennas and Wireless Propagation Letters*, *12*, 329-332.

[7] Huff G.H. and Bernhard. J.T. (2008). "Reconfigurable Antennas". In C.A. Blains. Modern Antenna Handbook. John Wiley &Sons.Panagamuwa, C. J., Chauraya, A., &Vardaxoglou, J. C. (2006). Frequency and beam reconfigurable antenna using photo conducting switches. IEEE Transactions on Antennas and Propagation, 54(2), 449-454.

[8] Huff G.H. and Bernhard. J.T. (2008). "Reconfigurable Antennas". *In C.A. Blains. Modern Antenna Handbook. John Wiley &Sons.*Panagamuwa, C. J., Chauraya, A., &Vardaxoglou, J. C. (2006). Frequency and beam reconfigurable antenna using photo conducting switches. *IEEE Transactions on Antennas and Propagation*, *54*(2), 449-454.

[9] Erdil, E., Topalli, K., Unlu, M., Civi, O. A., & Akin, T. (2007). Frequency tunable microstrip patch antenna using RF MEMS technology. *IEEE transactions on antennas and propagation*, *55*(4), 1193-1196.

[10] Liu, L. and Langley, R. (2008). "Liquid crystal tunable microstrip patch antenna". Electronics Letters. **44** (20).Doi:10.1049/el:20081995. Chico, J.C. Fu,. Chios, I.M.; and Li, M.;Delusion, L.Y. (1999). "MEMS reconfigurable antenna". *IEEE MTT-S International Microwave Symposium.* **4**.doi:10.1109/MWSYM.1999.780242.

[11] Rodrigo, D., Jofre, L., &Cetiner, B. A. (2012). Circular beam-steering reconfigurable antenna with liquid metal parasitics. *IEEE transactions on antennas and propagation*, *60*(4), 1796-1802.

[12] Aboufoul, T., Parini, C., Chen, X., &Alomainy, A. (2013). Pattern-reconfigurable planar circular ultra-wideband monopole antenna. *IEEE Transactions on Antennas and Propagation*, *61*(10), 4973-4980.

[13] Harrington, R. (1978). Reactively controlled directive arrays. *IEEE Transactions on antennas and propagation*, *26*(3), 390-395.

[14] Hum, S. V., &Perruisseau-Carrier, J. (2014). Reconfigurable reflect arrays and array lenses for dynamic antenna beam control: A review. *IEEE Transactions on Antennas and Propagation*, *62*(1), 183-198.

[15] Simons, R. N., Chun, D., &Katehi, L. P. (2002). Polarization reconfigurable patch antenna using micro electro mechanical systems (MEMS) actuators.

[16] Yang, X. S., Wang, B. Z., Wu, W., & Xiao, S. (2007). Yagi patch antenna with dualband and pattern reconfigurable characteristics. *IEEE Antennas and Wireless Propagation Letters*, *6*, 168-171.

[17] Aboufoul, T., Chen, X., Parini, C. G., &Alomainy, A. (2014). Multiple-parameter reconfiguration in a single planar ultra-wideband antenna for advanced wireless communication systems. *IET Microwaves, Antennas & Propagation*, *8*(11), 849-857.