VOL. 14, NO. 1, JANUARY 2019 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

DESIGN AND ANALYSIS OF FREQUENCY RECONFIGURABLE ANTENNA FOR SOFTWARE DEFINED RADIO

T. Vijetha and R. Karthik
Department of Electronics and Communication Engineering, MLR Institute of Technology, Hyderabad, India
E-Mail: tummalavijetha4444@gmail.com

ABSTRACT

Antennas play an important role in any wireless communications. Some of them are patch Antennas, parabolic reflectors, and Slot Antennas and Folded Dipole antennas. Each type of antenna is good in their own properties and their applications. The current trend in commercial communication systems has been to develop low cost, minimal weight, low profile antennas that are capable of maintaining high performance over spectrum of frequencies. This technological trend has focused much effort into the design of microstrip antennas. With the simply geometry, these antennas offer many advantages which are not commonly exhibited in other antenna configurations. The Software defined radio is a radio in which all of their functions are defined automatically. Radio is a device which can transmit or receive signals only in the radio frequency. The use of software defined radio (SDR) is to make communications more flexible, by making communications reconfigurable at lower layers of the networking. The major challenge is to design small antennas which can be operated at different number of frequency bands. For this frequency reconfigurable antennas need to be designed in which frequency can be tuned so, a single antenna can able to operate at different frequency bands.

Keywords: software defined radio, antenna, return loss, insertion loss.

1. INTRODUCTION

The Software defined radio system is a kind of communication system, its modulation and demodulation will be done in the software. Software defined radio can be operated in radio frequency, so the antenna has to design to operate in the radio frequency range. Reconfigurable antenna is an important component in wireless communication system to operate in a number of bands for different applications. There are so many antenna designs for software defined radio; they may be reconfigurable or normal antennas depending upon the applications. Antennas can able to reconfigure their properties and can adapt the changes depending on the system requirements and environmental conditions which can improve these restrictions and provides additional functionality. There are different techniques which are investigated by researchers to reach multiband operations. These may designed by using different shaped-slots to create multiband and wideband [1-2]. However, these antennas are optimized for one of the frequency bands and may require additional reconfigurable tuning circuits for good impedance matching.

We propose a reconfigurable micro strip patch antenna with no additional matching circuits for WLAN systems at 2.4 GHz. 2.4 GHz band is commonly used by many WLAN systems. However, RF interference and noise level will be much higher at this band [3]. The proposed reconfigurable antenna can be used for an SDR or cognitive radio application where both frequency bands can be chosen to operate depending on the interference level for WLAN. There are various methods to achieve reconfigurability, by changing the frequency bands, by changing the polarisation characteristics, also by changing the radiation characteristics. In this design frequency recongfigurability can be to switch the antenna frequency in different frequency bands.

There are two different techniques to achieve the frequency reconfigurable antennas, they are switchable and tunnable. In switchable reconfigurability, PIN diodes are used so that the antenna's operating frequencies can be tuneable for different applications. Varactor diode can be used for tuning the antenna for different operating frequency bands. A switchable antenna design is proposed to switch between single, dual and tri bands applications [4-5]. Secondly, the designed antennas may fixed and can be modified to be reconfigurable with fine-tuning so that they can be used for more applications in both wireless and mobile communications with the ability to control the bands neously or independently over a wide range [6].

2. DESIGN PROCESS

The proposed antenna is a reconfigurable antenna with different slots .Reconfigurable can be attached with pin diodes and varactor diodes but in this proposed antenna fixed patches had been used to achieve frequency reconfiguability. The main aim of this antenna design is to be used for reconfigurablity with size of 50 x 50mm^2 including ground plane The proposed antenna can be used in different wireless applications [7-8].

The proposed antenna can be turned over a wide range of frequencies starting 0.5 GHz to 3 GHz. There are different techniques to achieve the frequency reconfigurability like using different shapes and different slots. The technique used in this proposal to achieve the frequency reconfigure ability is by using different slots in two sub patches such as U shape slot in one sub patch and rectangular slot in another sub patch.

The structure of the designed reconfigurable antenna is shown in Figure-1 and the dimensions of designed antenna were shown in Table-1. The designed Antenna consists of 4 sub patches which are fixed to the feed line, ground plane. The substrate used in designed

antenna is FR-4 and thickness of the substrate is 1.6mm, whose dielectric constant is 4.6.

Table-1. Dimensions of the proposed antenna.

	Length (mm)	**Width** (mm)	**Slot (length,width)** (mm)
Sub Patch-1	24	8	--
Sub patch-2	24	10	U slot(19,7)
Sub patch-3	24	10	Square(14,6)
Sub patch-3	24	12	--
Feed line	12.5	3	
Shorted patch-1	3	2	
Shorted patch-2	3	2	
Shorted patch-3	3	2	
Shorted patch-4	3	2.5	
Total antenna	45.5	50	

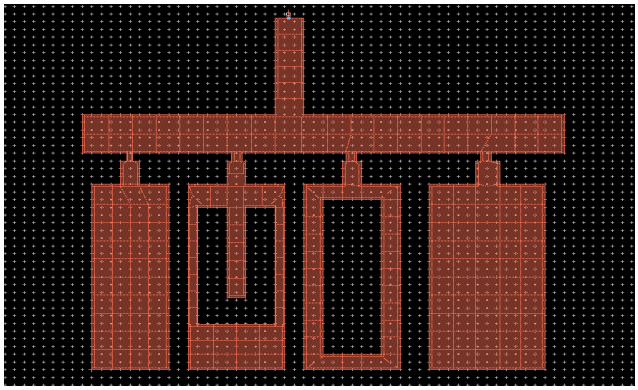

Figure-1. Structure of proposed antenna.

3. SIMULATION

The designed antenna was simulated using ADS software (advanced designed system). In the designed antenna there are four sub patches in which two sub patches are normal rectangular patches and another two are of slotted sub patches, one of them is U shaped slot and other is rectangular slot. All four sub patches are fixed to the feed line by placing a small conductorstrips in between the sub patches and a feed line. After simulating the antenna in ADS software the return loss can be obtained .the return loss of the designed antenna is shown Figure-2.

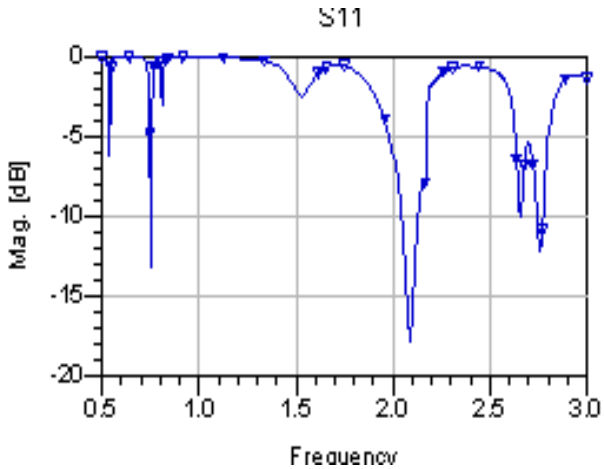

Figure-2. Return loss characteristics.

The simulated results of antenna can be verified by fabricating the antenna and the return loss is measured in network analyzer as shown in Figure-3. The designed antenna had fabricated on a PCB, with the thickness of the substrate is 1.6mm^2, dielectric constant is 4.4.

Figure-3. Photograph of reconfigurable antenna connected to a network analyser.

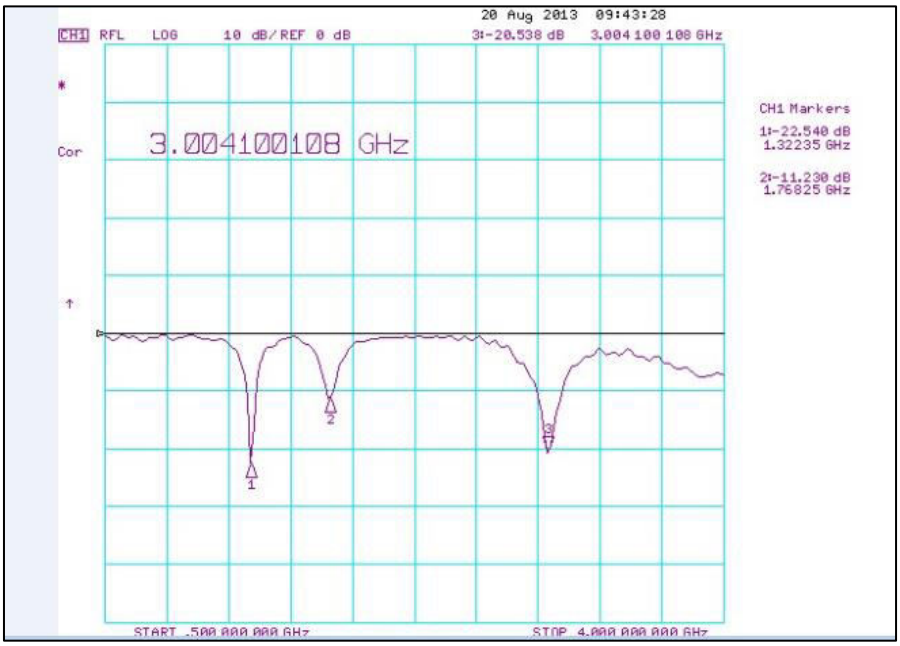

Figure-4. Return loss of the fabricated reconfigurable antenna.

4. CONCLUSIONS

This paper presents a design of reconfigurable micro strip patch antenna. All four sub patches are biased to feed line to achieve the band switching. The designed antenna is perfectly matched and achieved a gain of approximately 12 dB. And the size of antenna is small wireless system. The return loss measured in ADS can able to switch between three different frequencies which are 800 GHz, 2.2 GHz and 2.8GHz, which are approximately matched with fabricated antenna return loss measured with network analyzer.

ACKNOWLEDGEMENT

The authors would like to thank Department of Science and Technology (DST), Govt. of India for financial support for the WOS-A project File No: SR/WOS-A/ET-94/2016.

REFERENCES

[1] Reconfigurable Antennas Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, Morgan & Claypool.

[2] S. Yang, A. Kishk, K. Lee. 2008. Frequency Reconfigurable U-Slot Microstrip Patch Antenna. IEEE Antennas and Wireless Propagation Letters. 7: 127-129.

[3] 2008. Dual Band Reconfigurable Slot Antenna with High Frequency Ratio, T. Debogovic, A. Karabelj, J. Bartolic Department of Wireless Communications, FER, University of Zagreb Unska 3, Zagreb, Croatia, MRRS-2008 Symposium Proceedings. Kiev, Ukraine, September 22-24.

[4] Widely tunable multiband reconfigurable patch antenna for wireless applications.

[5] Y. Yorozu, M. Hirano, K. Oka and Y. Tagawa. 1982. Electron spectroscopy studies on magneto-optical media and plastic substrate interface. IEEE Transl. J. Magn. Japan, 2: 740-741, August 1987 Digests 9th Annual Conf. Magnetics Japan, p. 301.

[6] Antenna theory analysis and design third edition Constantine A. Balanis, A John.

[7] T. Vijetha, U. Dhanalaxmi, S Sai Sneha. 2016. Design of Reconfigurable Meander-line MIMO Antenna for Cognitive Radio. International Journal for Research Trends and Innovation. 1(2): 43-45.

[8] T. Vijetha, R Karthik. 2017. Design and Simulation of a Meander-line Antenna for CR Applications. International Journal Mechanical Engineering and Technology. 8(5): 749-754.