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DESIGN AND STUDY OF FREQUENCY RECONFIGURABLE MICROSTRIP RECTANGULAR PATCH ANTENNA USING INVERTED C SHAPED SLOT FOR MULTIBAND APPLICATIONS

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ABSTRACT

In this paper present, compact, only feed, various frequency reconfigurable Micro strip patch switchable to inverted C- slot antenna is proposed. Firstly design a basic 3.64 GHz inset feed antenna. In this design, a inverted C-slot inserted on the square patch of the 3.64 GHz antenna and two copper strip switches (like Ideal Diode) are puts inverted C-slot. proposed antenna is competent of frequency switching at four different application like- 1.85 GHz Personal communication system (PCS), 2.3 GHz Telemetry Tracking and Control (TTC), 2.56GHz (WiMax technology), 2.84GHz(Air Traffic Control). Reproduced results are used to exhibit the presentation of the antenna.

Keywords: *Rectangular Antenna, Reconfigurable Antenna, Return Loss, Copper Strip (Like Ideal Diode), Single Feed*.

Introduction

"During the past few decades, the idea of reconfigurable antenna proposed in early 1990s" [1]. "In 1979 a reconfigurable antenna was designed for satellite communication"[2]. "In 1999 a reconfigurable leaky patch antenna using PIN diode was presented"[3]. "From 1999 a micro strip patch antenna has been used a platform to design reconfigurable antenna"[4]. The proposed antenna is capable for four different applications.

Today, in wireless communication there is a demand of 'smart' antenna to tune their different characteristics (frequency, polarization, radiation) according to the requirement. Whenever for four different application using four different antenna which increase the cost of antenna and increase the space requirement of the antenna and their isolation. Reconfigurable antenna is an antenna that competent to minimize the number of antenna required in a particular system. This type of antenna is competent to change radiation characteristics as well as antenna electrical properties by switching element. A inverted C-slot inserted into the square patch and Copper strips (like ideal Diode) are placed in the inverted C-slot. Both switches are simultaneously ON and OFF.

When upper copper strip (ON) and lower copper strip (OFF) Condition in inverted c-slot, frequency is 1.85GHz for the use of personal communication system (PCS). When upper and lower copper strip (OFF) condition, frequency is 2.3GHz for the use of telemetry tracking and control (TTC) this application is use in military. When upper copper strip(OFF) and lower copper strip(ON) condition, frequency is 2.56 GHz for the use of Wi-Max Technology, When upper and lower copper strip(ON) condition, frequency is 2.84GHz for the use of(Air Traffic Control).

In this paper a frequency- reconfigurable micro strip patch switchable to inverted C-slot antenna is proposed. The proposed antenna a inverted C-slot inserted in the square patch and two copper switches (like ideal Diode) in the inverted C-slot. Two copper strips are used to reconfigurable four different applications. The design approach and simulation are presented and discussed.

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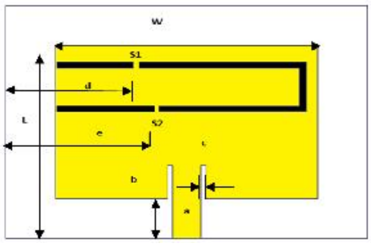
Antenna Design and Configuration

The proposed antenna is portrayed in this segment. The Geometry of the conventional reconfigurable micro strip-patch antenna is considered for 3.64 GHz frequency and a inverted C-slot as show in Fig.1. The antenna is simulated on FR epoxy substrate ε_r = 4.4 with thickness (h) of 1.6mm are used for antenna design. The patch size is 18.54 × 25.35 mm^2. The width of the slot is 0.7 mm. The size of the copper strips (like Ideal diode) is 0.7× 0.5 mm^2. The dimension of the antenna is tabulated in Table 1. The proposed antenna is utilized an inset feed procedure to coordinate the impedance between the patch and transmission line. Appropriate impedance coordinating produces the best return loss at the needed frequency. Two switches are put in the inverted C-slot .The first switches S1 is placed at a distance of d= 12.34mm from *x*-axis in upper side of inverted C-slot, while the second switches S2 is set at distance of e=14.34mm from x-pivot in lower side of inverted c -space. By changing the status of switches S1 and S2 at four unlike resonant frequencies can be produced as show in Table 2. The projected reconfigurable antenna is reproduced utilizing HFSS tool.



(a)

Figure1. Geometry of the projected reconfigurable microstrip-patch antenna

Table 1: Dimension of the Designed Antenna

Parameters	Dimension(mm)
W	25.35
L	19.75
a	2.7
b	5
c	0.5
d	12.34
e	14.34

Result and Discussions

The theoretical analysis was performed using HFSS code [5] In this plan, copper strips are utilized to supplant the ON and OFF conditions of the diodes. The legitimacy of this improvement has been exhibited in [6-7].The Simulated antenna of 3.64 GHz is illustrate in Figure.2 (a) and Figure2 (b).shows the simulated return loss result of the 3.64 GHz antenna. In Figure3 (a) shows the when switch S1 (ON) and S2 (OFF), we got 1.85 GHz frequency. Figure3 (b) show the simulated return loss result. When both switches are OFF, we got 2.3 GHz frequency and Simulated return loss result are shows in Figure4 (a),(b). In Figure5 (a) when S1(OFF) and S2(ON), we got 2.56 GHz frequency and simulated return loss result are shows in Figure5(b). In Figure6 (a) when both switches S1(ON) and S2(ON), we got 2.84 GHz frequency and simulated return loss result are shows in figure6(b).An observed, the simulated antennas are capable to reconfigurable to four different frequency. Switch Configuration, resonant frequency, return loss and application are summarized in Table 2.

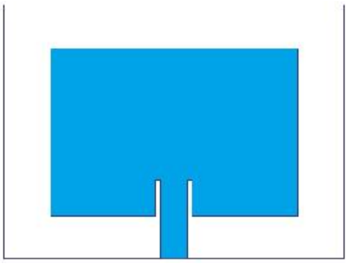
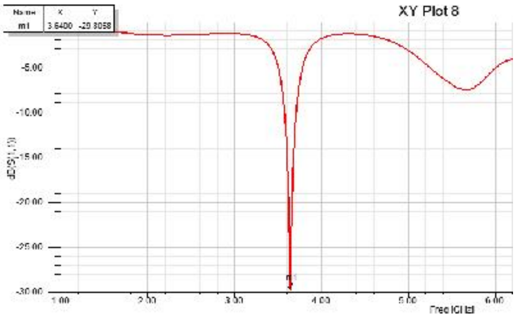


Figure 2 (a): Basic 3.64 GHz Antenna



(b): Simulates return loss

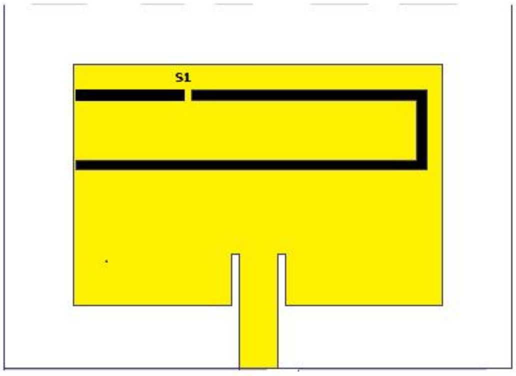
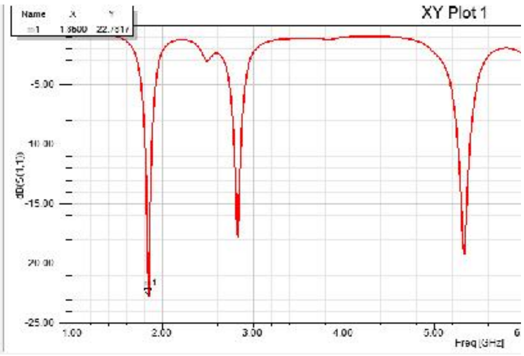


Figure3 (a): When S1 (ON) and S2 (OFF)



(b): Simulated Return Loss When S1 (ON) and S2 (OFF)

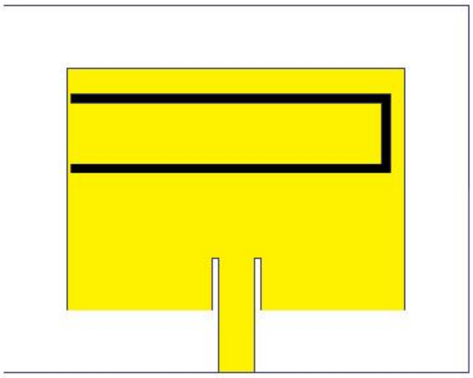
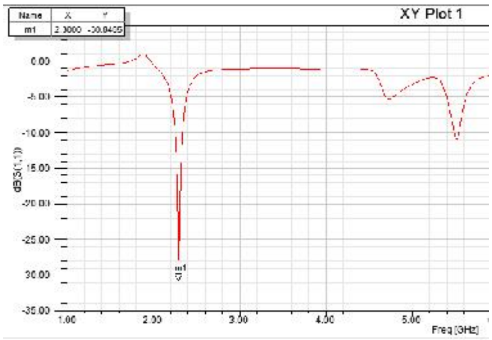


Figure 4 (a): When S1 (OFF) and S2 (OFF)



(b):Simulated Return Loss when S1 (OFF) and S2 (OFF)

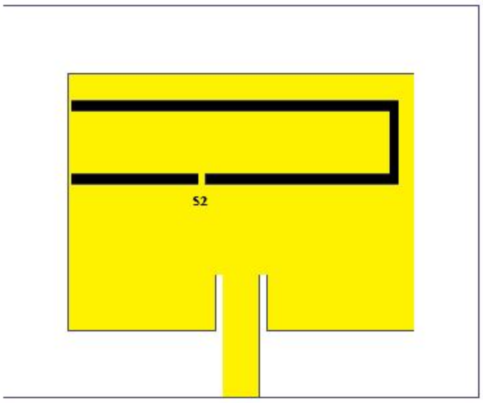
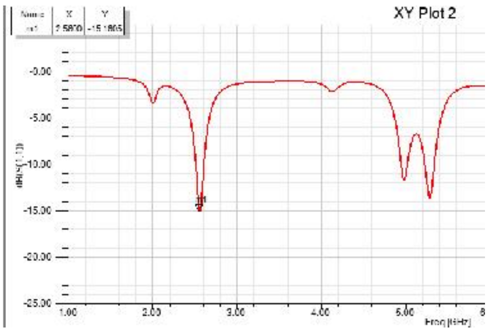


Figure 5 (a): When S1 (OFF) and S2 (ON)



(b): Simulated return loss When S1 (OFF) and S2 (ON)

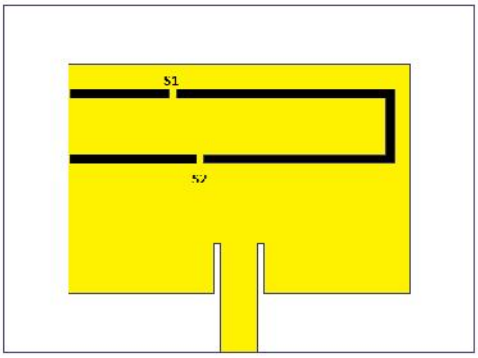
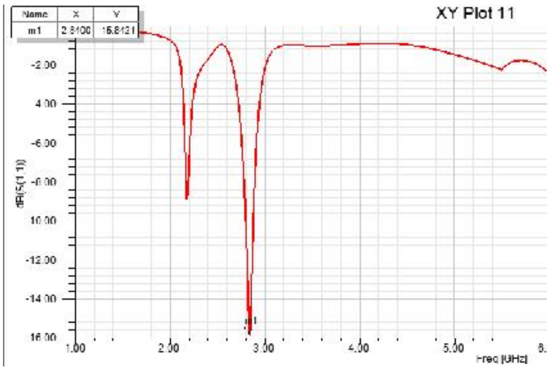


Figure 6 (a): When S1 (ON) and S2 (ON)



(b): Simulated return loss When S1 (ON) and S2 (ON)

Table 2: Switch Configuration, Resonant Frequency, Return Loss and application of the proposed antenna

S1	S2	Resonant frequency in GHz	Return loss in dB	Application
ON	OFF	1.85	-22.7817	Personal communication service (frequency range 1.85- 1.99 GHz)
OFF	OFF	2.3	-30.8485	TTC for S band
OFF	ON	2.56	-15.1605	WiMax (frequency range 2.56 – 2.7 GHz)
ON	ON	2.84	-15.8421	Air traffic control (ATC Frequency Range 2.2 – 3.9 GHz)

Conclusions

A frequency reconfigurable micro-strip patch switchable to opening has been introduced. It very well may be accomplished by embeddings switches in the space of the antenna. The proposed antenna is able to four unlike frequency from 1.85GHz to 2..84 GHz.The proposed antenna is an attractive candidate for PCS/TTC/WiMax/Air Traffic Control.

References

[1]. Haupt, R. L. and M. Lanagan, "Reconfigurable antennas," *IEEE Antennas and Propagation Magazine*, Vol. 55, No. a, 49-61, 2013.

[2]. DiFonzo, A.D. karmel, and P. Atia,"Multiple shaped beam reconfigurable satellite antenna," *IEEE Antennas and Propagation Society International Symposium,* Vol. 17, 457-460, 1979.

[3]. Chang, B.C.C.Y. Qian, and T. Itoh, "A reconfigurable leaky mode/patch antenna controlled by PIN diode switches," *IEEE Antennas and Propagation Society International Symposium,* Vol. 4, 2694-2697, 1999.

[4]. Pourized, A.S. Nikmehr, and H. Valadi, " A novel multi-state integrated RF MEMS switch for reconfigurable antennas applications," *Progress In Electromagnetics Research*, Vol. 139, 389-406,2013.

[5]. Ansoft High-Frequency Structure Simulator (HFSS), ver. 9.2, Ansoft Corporation.

[6]. F. Yang and Y. Rahmat-Samii, "Patch Antenna with switchable slot (PASS): Dual-frequency operation" Microwave Opt Technol Lett 31 (2001), 165-168.

[7]. F. Yang and Y. Rahmat-Samii, "Switchable dual-band circularly polarized patch antenna with single feed," Electronics Lett 37 (2001). 1002-1003.