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Implementation of Inverted C- Shape Slot Microstrip Patch Antenna for Wireless Communication

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Abstract: In this paper simulate, a compact, single feed, various frequency reconfigurable Micro strip patch Switchable to inverted C- slot antenna is proposed. Firstly design a basic 3.6 GHz inset feed antenna. In this design, a inverted C-slot inserted on the square patch of the3.6 GHz antenna and two copper strips witches (like Ideal Diode) are placed in the inverted C-slot. The proposed antenna is capable of frequency switching at four different application like-1.9GHz Personal communication system (PCS),2.2GHzTelemetry Tracking and Control(TTC),2.6GHz (WiMax technology),2.9GHz (AirTraffic Control).Simulated results are used to demonstrate the performance of the antenna.

Keywords: Reconfigurable antenna, Return loss, Copper strip , single feed.

I. INTRODUCTION

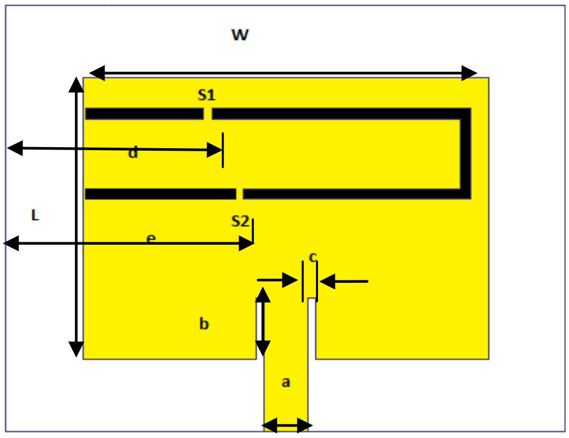
Today, in wireless communication there is a demand of ‘smart’ antenna to tune their different characteristics (frequency, polarization, radiation) according to the requirement. Whenever for four different application using four different antenna which increase the cost of antenna and increase the space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

When upper copper strip(ON) and lower copper strip (OFF)Condition in inverted c-slot, frequency is 1.9GHz for the use of personal communication system(PCS). When upper and lower copper strip (OFF) condition, frequency is 2.2GHz 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 2.6 GHz for the use of Wi-Max Technology, When upper and lower copper strip(ON) condition, frequency is 2.9GHz 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.

II. Antenna Design and Configuration

The proposed antenna is described in this section. The Geometry of the conventional reconfigurable microstrip-patch antenna is designed for 3.6 GHz frequency and a inverted C-slot as show in Fig.1. The antenna is simulated on FR epoxy substrate $\varepsilon_r = 4.4$ with thickness (h) of 1.6mm are used for antenna design. The patch size is 18× 25 mm.The width of the slot is 0.5 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 used a inset feed technique to match the impedance between the patch and transmission line.Proper impedance matching produces the best return loss at the wanted frequency.Two switches are placed in the inverted C-slot .The first switches S1 is placed at a distance of d= 12.3mm from *x*-axis in upper side of inverted C-slot, while the second switches S2 is placed at a distance of e=14.3mm from *x*-axis in lower side of U-slot. By changing the status of switches S1 and S2 at four different resonant frequencies can be produced as show in Table 2. The proposed reconfigurable antenna is simulated using HFSS software.



(a)

Figure1. Geometry of the proposed reconfigurable microstrip-patch antenna

Table1: Dimension of the designed antenna

Parameters	Dimension(mm)
W	25
L	18
a	2.7
b	4
c	0.5
d	12.3
e	14.3

III. Result and Discussions

The theoretical analysis was performed using HFSS code [5].In this design, copper strips are used to replace the ON and OFF states of the diodes. The validity of this simplification has been demonstrated in [6-7].The Simulated antenna of 3.6 GHz is illustrated in Figure.2 (a) and Figure2 (b).shows the simulated return loss result of the 3.6 GHz antenna. In Figure3 (a) shows the when switch S1 (ON) and S2 (OFF), we got 1.9 GHz frequency. Figure3 (b) show the simulated return loss result. When both switches are OFF, we got 2.2 GHz frequency and Simulated return loss result are shows in Figure4 (a),(b). In Figure5 (a) when S1(OFF) and S2(ON), we got 2.6 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 2.9 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.

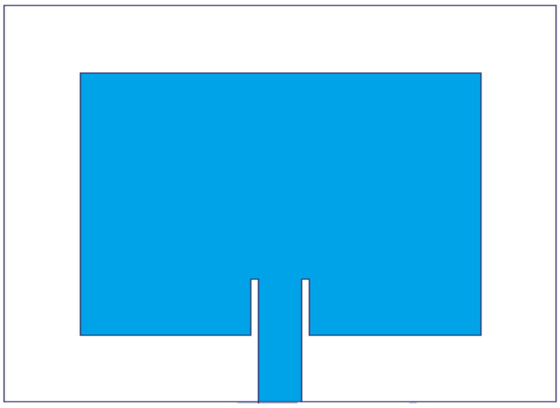


Figure2 (a): Basic 3.6 GHz antenna

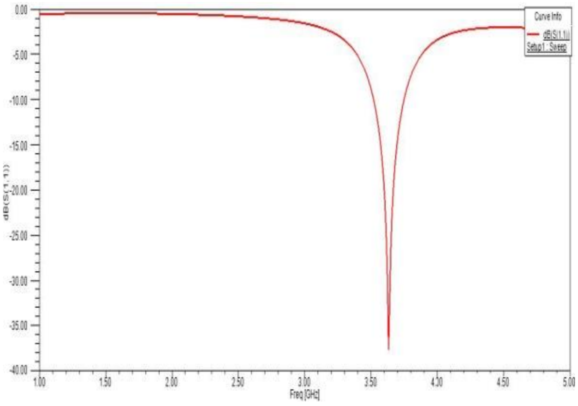


Figure2 (b): Simulates return loss

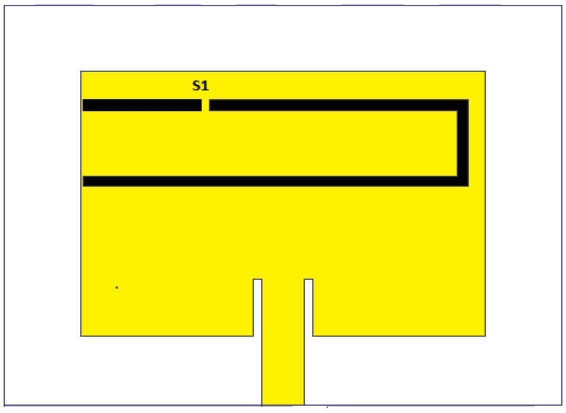


Figure3 (a): When S1(ON) and S2(OFF)
(1.9GHz frequency)

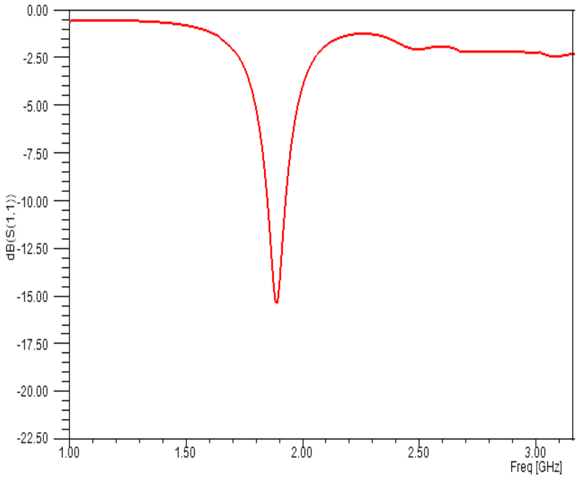


Figure3 (b): Simulated Return loss

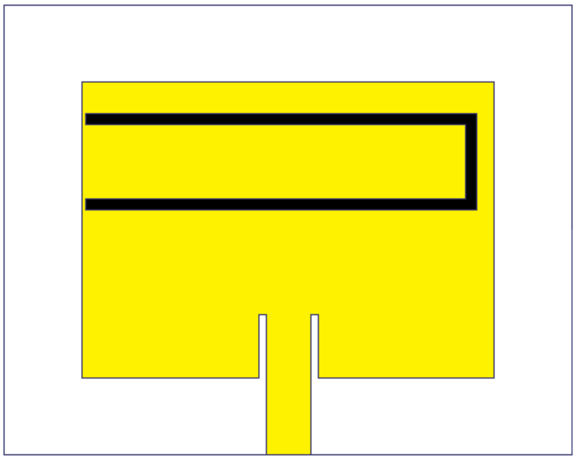


Figure4 (a): When both switch(OFF)
(2.2GHz frequency)

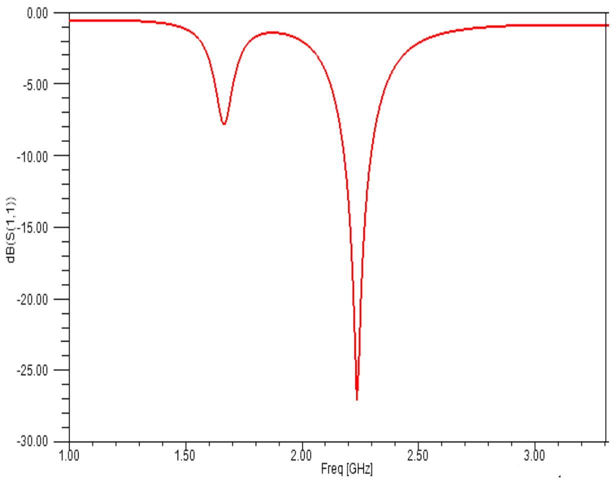


Figure4 (b): Simulated return loss

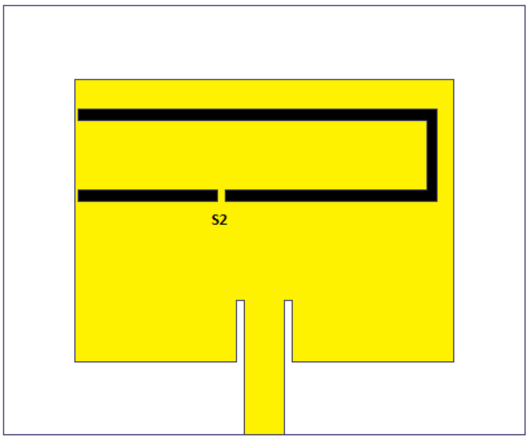


Figure5 (a): When S1(OFF) and S2(ON) (2.6GHz frequency)

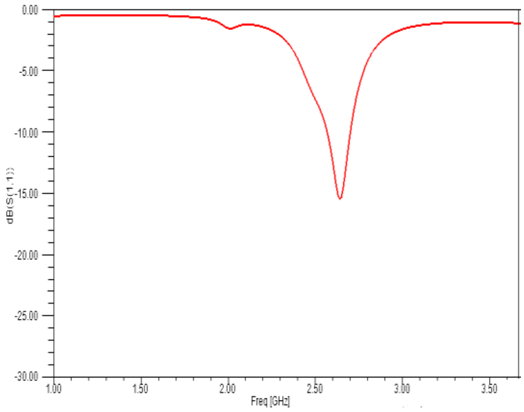


Figure5 (b): Simulated return loss

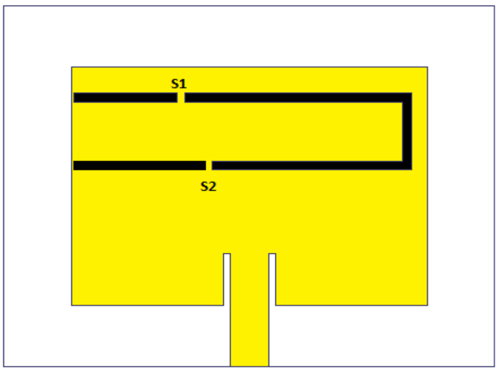


Figure6 (a): When S1(ON) and S2(ON) (2.9GHz frequency)

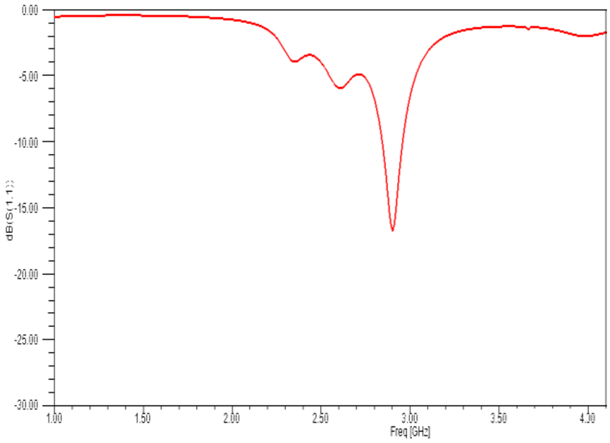


Figure6 (b): Simulated return loss

Table2 : Switch Configuration ,resonant frequency, return Loss and application of the proposed antenna

S1	S2	Resonant frequency	Return loss	Application
ON	OFF	1.9	-15.3654	Personal communication service(PCS)
OFF	OFF	2.2	-27.0905	TTC
OFF	ON	2.6	-15.3015	WiMax
ON	ON	2.9	-16.7621	Air traffic control

IV. CONCLUSIONS

A frequency- reconfigurable microstrip patch switchable to slot has been presented. It can be achieved by inserting switches in the slot of the antenna. The proposed antenna is capable to four different frequency from 1.9GHz to 2.9GHz.The proposed antenna is an attractive candidate for PCS/TTC/WiMax/Air Traffic Control.

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