A Novel Dual-band Reconfigurable Frequency Selection Surface

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***Abstract*—Based on the switch active frequency selection surface beam reconfigurable antenna, an AFSS design structure with single double frequency switching characteristics is obtained by loading PIN diodes on four feet of the deformed cross structure. The structure improves the polarization stability and angle stability, and provides a new design idea for FSS in complex electromagnetic environment.**

Keywords—Active frequency selection surface; PIN diode; Single double frequency switching

I. INTRODUCTION

The frequency selection surface is a single or multilayer structure which is arranged periodically by the resonant unit on the medium layer. Therefore, the designer can design different electromagnetic parameters to regulate electromagnetic wave transmission according to demand. With the rapid development of communication technology, the traditional frequency selection surface has no ability to meet the needs, therefore, the new functional features of the FSS has become the current research focus [1]-[3],By adding active devices(such as PIN diodes and capacitive diodes) to the traditional frequency selection surface, and adjusting the control material, a controlled spatial filter with frequency selection characteristics, known as active FSS or active grid array, can be obtained [4]-[6], The active frequency selection surface can change the resonant frequency according to the need and can adapt to the external environment,which will be more conducive to meet the current complex electromagnetic environment engineering requirements [7].

Based on the resonant principle of frequency selection and the configurable antenna of switched active frequency selection, an AFSS design structure with the characteristic of single double frequency switching is proposed. The function of single double frequency switching is realized by adjusting bias voltage to control the pass of pin diode.

II. THE FSS STRUCTURE AND DESIGN

As shown in Figure.1, the dielectric uses a dielectric constant of 4.4, a positive tangent loss of 0.02, a thickness of 0.6 mm as well as a length and width of $30\sqrt{2}$ mm of FR4_epoxy.

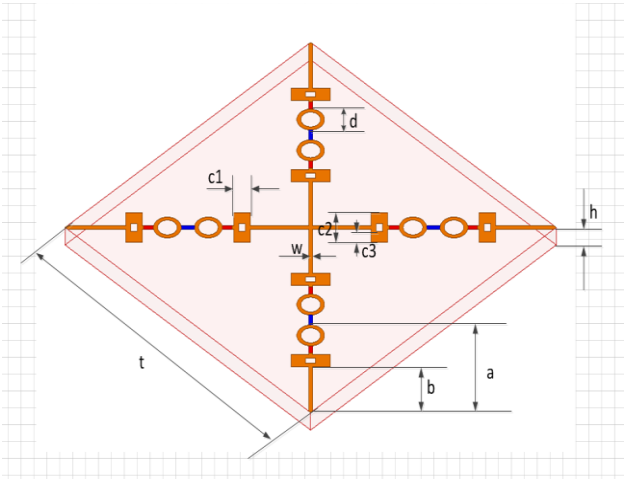


Figure. 1

Parameters as shown in table 1 below:

TABLE I.

Parameters	a	b	c1	c2
Value	14.2mm	7.4mm	2mm	4.8mm
Parameters	c3	d	w	
Value	1.8mm	3.4mm	0.5mm	

III. RESULT AND DISCUSSION

For the structure designed in this paper, the red part is inductance, L = 40nH, and the blue part is PIN diode, whose resistance value is R = 3Ω. Figure.2 and Figure.3 are the simulation results of the structure in the different states. It can be seen that when PIN diodes are connected, a band is created, and when pin diodes are in disconnection, a second band is created at a lower frequency.

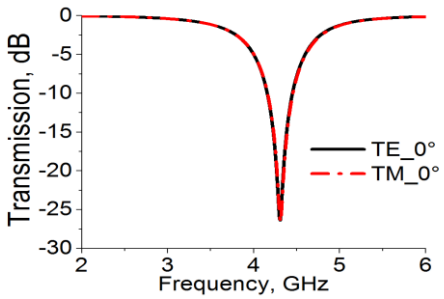


Figure. 2 Transport characteristics in on state

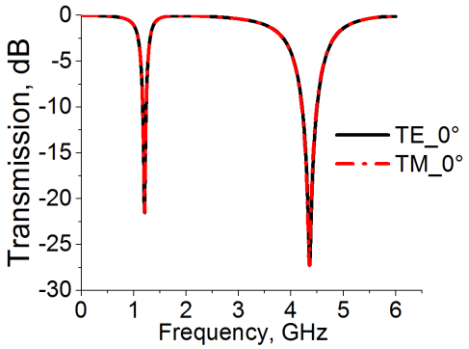
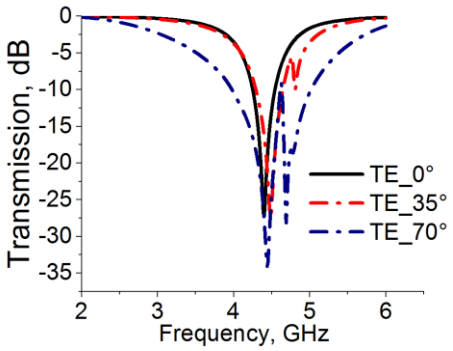
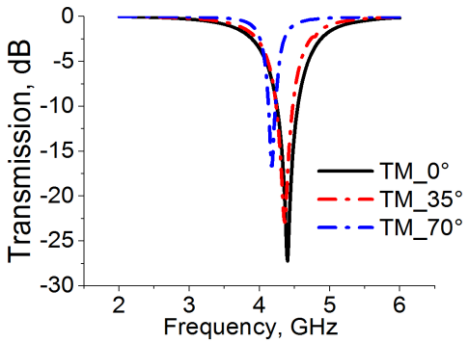


Figure. 3 Transport characteristics in off state

The transport coefficient curves of TE and TM at the range of 0 °~ 70 °are simulated in the different states respectively, The results of the simulation are shown in Figure .4 and Figure .5.

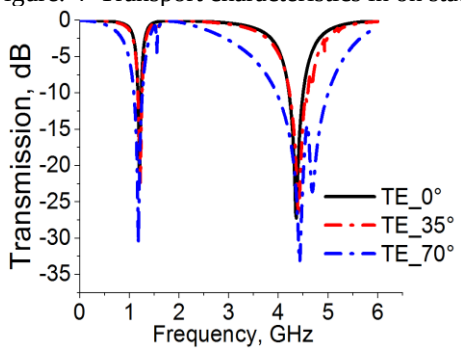


(a)

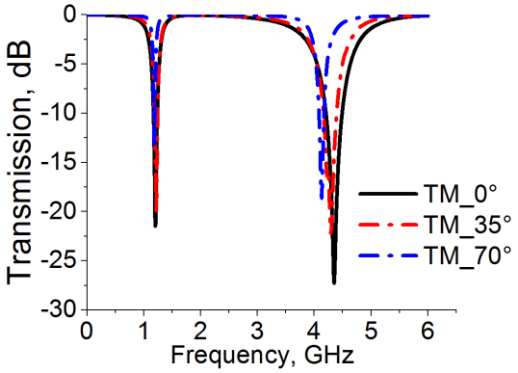


(b)

Figure. 4 Transport characteristics in on state



(a)



(b)

Figure. 5 Transport characteristics in off state

IV. CONCLUTION

In this letter, we propose a single double frequency switching band resistance frequency selection surface structure. When the PIN diode is connected, the frequency selection surface has only one band near 4.4GHz, when the PIN diode is disconnected, the frequency selection surface has the same band near 4.4GHz, and another band appears near 1.1GHz. This kind of single double frequency switch, simple structure and easy implementation of FSS, which provides a new design idea for practical engineering application.

a.

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