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T SLOT ANTENNA FOR MOBILE TERMINALS USING 5G MM WAVE ANTENNA ARRAY

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Abstract: *To improve the performance of the 5G mm-wave antenna array, an antenna array based on the T-slot antenna is proposed. It is demonstrated that the 3D radiation pattern can be optimized when the T-slot antenna is adopted. It is also shown that compared to the normal rectangular slot antenna array, the radiation pattern of the T-slot antenna array is more suitable for mobile phone application because the T-slot antenna has more uniform antenna gain. To improve the values of S-parameters two dimensional T shaped antenna is proposed.*

Keywords: *5G, T-Slot antenna, antenna array, Radiation patterns, S-parameters*

I. INTRODUCTION

To obtain greater transmission rate, the millimeter-wave phased array antenna will play a prominent role in the 5G communication system. In July 2016, The FCC(Federal Communication Commission) announced three mm-wave bands which will be used in the US: the 28 GHz band (27.5-28.35GHz), the 37GHz band(37-38.6GHz) and the 39GHz band(38.6-40GHz).

Slotted waveguide antenna array is a good candidate in the areas of radar and communication systems due to its attractive features, such as low power loss, low cross-polarization levels, low profile, high power capacity, high efficiency, and accurate control of amplitude and phase distributions. Some edge slot antenna arrays have been researched[1-6]. The edge slot waveguide antenna can be integrated with the other antennas for dual polarization applications[7-9]. The slots etched on the narrow wall of the waveguide are usually cut into adjacent broad walls[1-3] or folded T-shaped [4-6] to achieve the resonance.

II. ANALYSIS OF T-SHAPED WAVEGUIDE

The rectangular waveguides are usually used as a radiating waveguide for the edge slotted waveguide antennas with the slots cutting into the broad walls for resonance. The novel T-shaped waveguide is firstly introduced as a radiating waveguide in[10] and the cross section of the waveguide becomes T-shaped as shown in Figure 1(a). The port field in the dominant mode and the surface current on the top plate of the T-shaped waveguide are studied and they are depicted in Figure 1(b) compared with a rectangular one. It can be seen that the port field and surface current on the top plate of the two waveguides are similar to the TE dominant mode. Therefore, the inclined radiating slots etched on the top plate of the T-shaped waveguide can cut the surface current and be designed like the regular ONES.

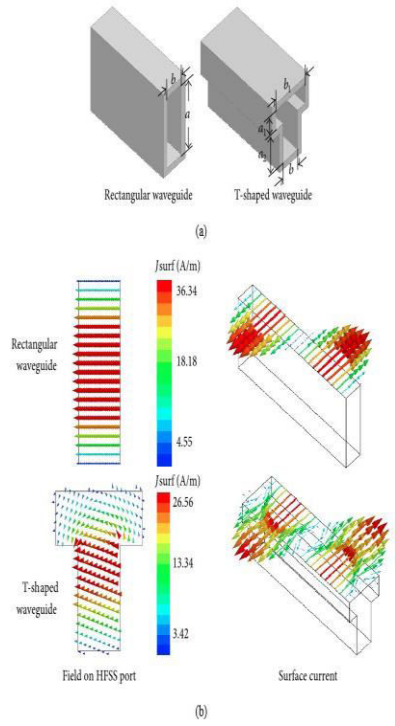


Figure 1(a),1(b)

The perspective and top and side views of the normal rectangular slot antenna and the T-slot antenna proposed in this paper.

III. SIMULATION & ANALYSIS

Radiation patterns at the center frequency of the antenna array are shown in figure 5. As is known to all, the theoretical side lobe level(SLL) of the uniform array is around -13.2dB and then tapered

from the first side lobe to far-out side lobe. The simulated gain is 19.1dBi and observed SLL is 15dB with almost uniform value over a wide angle range which is different from the theoretical situation.

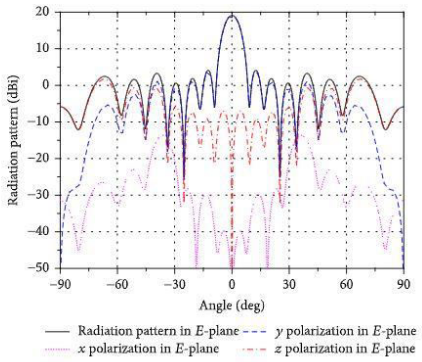
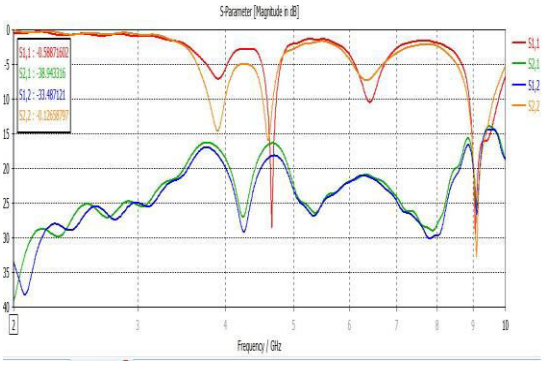


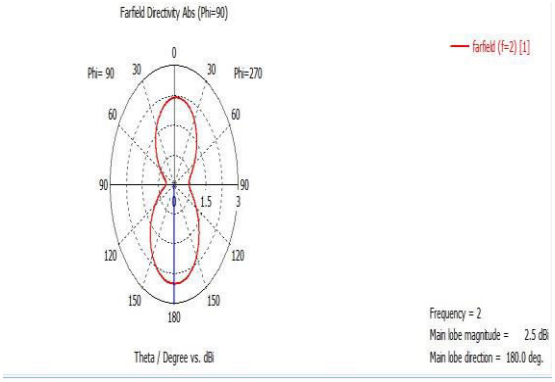
Figure 5: Simulated *E*-plane radiation patterns at 35 GHz.

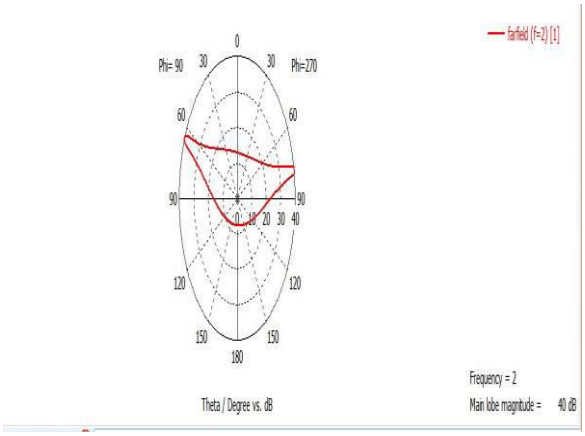
III. RESULT

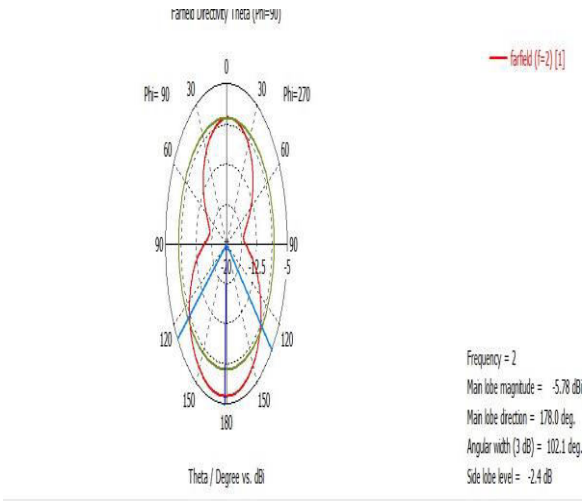
Enhanced the values of S parameters by extended to MIMO(Multi input Multi Output), observed the radiation patterns for different values and plotted all the waveguide parameters(power losses, surface current, efficiencies, far fields, ports(both E and H fileds)).



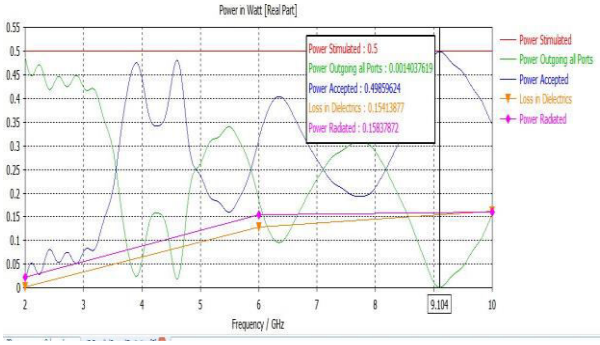
Far fields







Efficiencies:



IV. CONCLUSION

A phased array antenna system based on the T-slot antenna that can be used in mobile terminals is proposed. The return loss, radiation and scanning behavior of the T-slot antenna are investigated. Compared to the normal rectangular slot antenna, the antenna gain of the T-slot antenna is more uniform and thus it is more suitable for the 5G mm-wave mobile terminal application.

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