

Eight-port MIMO Slot Antennas for Wi-Fi 7 Access Point Applications

Cheng-Yi Ye

Department of Electronic Engineering
Southern Taiwan University of Science
and Technology
Tainan City, Taiwan
4a930148@stust.edu.tw

Bing-Hong Cai

Department of Electronic Engineering
Southern Taiwan University of Science
and Technology
Tainan City, Taiwan
MB130204@stust.edu.tw

Wen-Shan Chen

Department of Electronic Engineering
Southern Taiwan University of Science
and Technology
Tainan City, Taiwan
chenws@stust.edu.tw

Abstract—The paper presents an 8×8 MIMO access point antenna designed for use in the Wi-Fi 7 frequency bands. The 8×8 MIMO antennas use microstrip lines to excite inverted open L-shaped slots and closed step-width slots for the frequency bands. The antenna material used in this experiment is glass fiber board (FR4), with a dielectric constant of 4.4, loss tangent of 0.0245, and thickness of 1.6 mm. The overall dimensions of the design are $100 \times 100 \times 34.45 \text{ mm}^3$, and 50-ohm SMA connectors connected to microstrip lines are used to excite the antenna, and with a distance of 31.25 mm between the MIMO antennas and the reflector. From the results, the design can cover all bands of Wi-Fi 6E/7. Therefore, this antenna is suitable for use in Wi-Fi 6E/7 MIMO antennas on access point applications.

Keywords—Wi-Fi 6E/7, MIMO, Slot Antenna, Access point applications.

I. INTRODUCTION

Wireless products with Wi-Fi systems are widely used in the world. Wi-Fi system is upgraded to Wi-Fi 7. The Wi-Fi 7 also supports MIMO technology to increase data rate in use. The antenna design for Wi-Fi 7 is more and more important for wireless products. There are several MIMO antennas design for access point applications published [1-4]. In Ref. [1], a design with slot structures is described, where a dual-polarized cross-slot MIMO antennas is excited by microstrip lines. Ref. [2] discusses a slot structure, with four cross-shaped dipoles positioned on the corner of the system circuit, covering LTE bands n42/43, while four inverted L-shaped open slots placed along the edge can support LTE band n46. Ref. [3] presents a mixed design composed of monopoles and open slots to resonate different operating bands. Ref. [4] presents a design using I-shaped and C-shaped slots to form the Wi-Fi 6E/7 6GHz band operation, and a reflector composed of 5×5 square patch elements forming an EBG is used to reduce the distance between the antenna and the reflecting surface.

The previous papers offer more design concepts, but the applications cannot cover all bands of Wi-Fi 7 systems. This paper presents a design of 8×8 MIMO slot antennas, which is suitable for Wi-Fi 2.4GHz, 5GHz, and 6GHz bands. It can achieve the required frequency bands by using microstrip lines to excite inverted L-shaped slots and closed step-width slots.

II. ANTENNA DESIGNS AND RESULTS

Fig. 1 shows the overall view of the design, with the overall dimensions of $100 \times 100 \times 34.45 \text{ mm}^3$. The design consists of a set of MIMO antennas and a reflector. The

MIMO antenna design is implemented on a FR4 board with a thickness of 1.6 mm, dielectric constant of 4.4, and loss tangent of 0.0245. The distance between the MIMO antennas and the reflector is 31.25 mm. Fig. 2 illustrates the feed structure of the design on the front side of substrate structure. The slot antennas are excited by microstrip lines. Fig. 3 shows the geometry of printed MIMO slot antennas on the back side of substrate. The inverted open L-shaped slotted and closed step-width slots are used to excite the modes for 2.4, 5, 6GHz bands of Wi-Fi 7. Four narrow rectangular slots are included in the design to improve isolation at 2.4GHz band. Tables 1 list the detail dimensions of the design. Fig. 4 presents the measured S-parameters of the MIMO antennas. Fig. 5 depicts the measured isolation S-parameter of the design. According to the data, the values of $S_{11} - S_{88}$ are all less than -10dB within the required application frequency bands for 2.4GHz band (2.4 – 2.484 GHz), 5 GHz band (5.15 – 5.825 GHz), and 6GHz band (5.925 – 7.125 GHz) of Wi-Fi 7 systems. The isolations for all operating bands are large than 9.7dB. The detail dimensions of the design are also listed in Table 1.

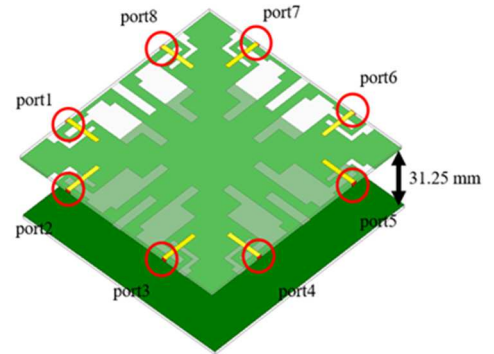


Fig. 1 Overall view of the MIMO antennas

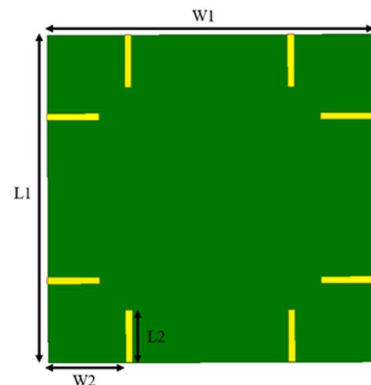


Fig. 2 Feed structure designed on the front side of the substrate structure

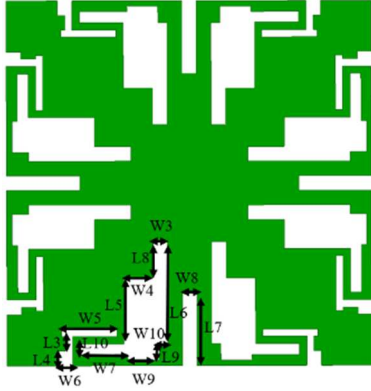


Fig. 3 Geometry of printed MIMO slot antennas on the back side of substrate

Table 1. Detailed dimensions of the design
(front side and back side)

front side				
Parameter	W1	W2	L1	L2
Unit (mm)	100	24	100	16
back side				
Parameter	W3	W4	W5	W6
Unit (mm)	4	8	15	4
Parameter	W7	W8	W9	W10
Unit (mm)	13	4	8.5	2.5
Parameter	L3	L4	L5	L6
Unit (mm)	4	4	18	28
Parameter	L7	L8	L9	L10
Unit (mm)	20	10	4.5	3

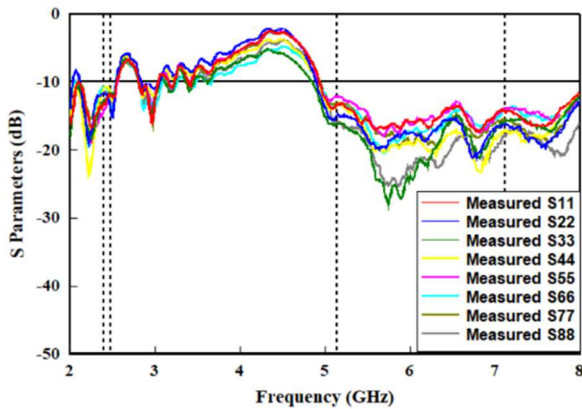


Fig. 4 Measured S-parameters of 2.4, 5, and 6GHz bands of Wi-Fi 7 systems

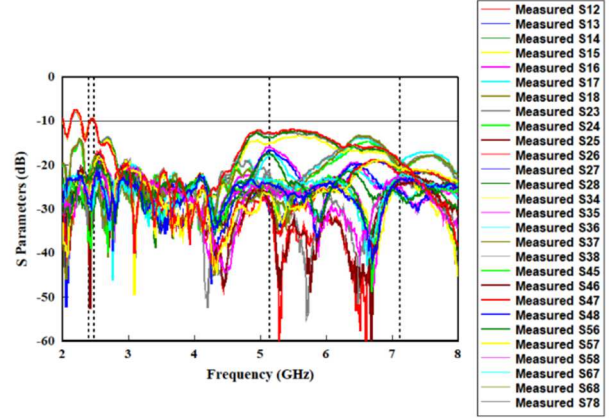


Fig. 5 Measured isolation S-parameters of 2.4, 5, and 6GHz bands of Wi-Fi 7 systems

III. CONCLUSION

This paper proposed a design with 8 microstrip lines to excite open inverted open L-shaped slots and closed step-width slots to resonate at the required frequency bands for Wi-Fi 6E/7. There are four narrow rectangular slots at the middle of four sides to improve the isolation for 2.4GHz band. From the results, the impedance match and isolation are all achieve the design goal. This design is suitable for 8×8 printed MIMO slot antennas for 2.4GHz, 5GHz, and 6GHz bands in Wi-Fi 6E/7 systems. The design with good performances is suitable for practical applications.

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