

# Design of Broadband Microstrip Quasi-Yagi Antenna with Double Branch Structure

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**Abstract**—A Broadband quasi-Yagi antenna is proposed for mobile applications. This antenna is mainly composed of two pairs of dipoles, two driving units, and a rectangular reflector. The simulation results show that the antenna has a wide impedance bandwidth of 2.35 GHz to 4.47 GHz (61.9%) and achieves a peak gain of 3.23 dBi at 4.3 GHz. Additionally, the antenna exhibits a stable radiation pattern and a radiation efficiency greater than 76%. This operating frequency range enables coverage and application in Sub-6 GHz and WLAN systems.

**Keywords**—quasi-yagi antenna, broadband antenna, sub-6G, WLAN

## I. INTRODUCTION

In recent years, the rapid advancements in WLAN and sub-6G technology have created a significant demand for broadband or multi-frequency antennas with superior performance. Among these, the microstrip quasi-Yagi antenna has garnered considerable attention due to its notable advantages, including high gain, a simple structure, and easy integration. However, it is important to address one of its limitations, which is its narrow bandwidth.

To overcome this challenge, researchers have explored various approaches to broaden the antenna's bandwidth. Some have focused on modifying the antenna's deficit structure, such as incorporating a broadband balun to enhance the antenna's bandwidth [1]. Using a wideband balun to change the impedance match at the input is a common method. Others have investigated changes in the directors and reflector structure to expand the antenna's bandwidth [2]. They usually use directors of various shapes and grooves in the reflectors. This method is simple and efficient. Additionally, the inclusion of new branches to enable the antenna to operate at multiple frequencies has also been explored [3]. This method increases the size of the antenna, but improves space utilization. These innovative techniques aim to overcome the narrow bandwidth drawback and enhance the overall performance of the microstrip quasi-Yagi antenna.

In this paper, a microstrip quasi-Yagi antenna is presented. The antenna employs two pairs of dipole antennas with a CPW feed structure to enable dual-frequency operation, thereby expanding the antenna's bandwidth.

## II. DESIGN OF ANTENNA

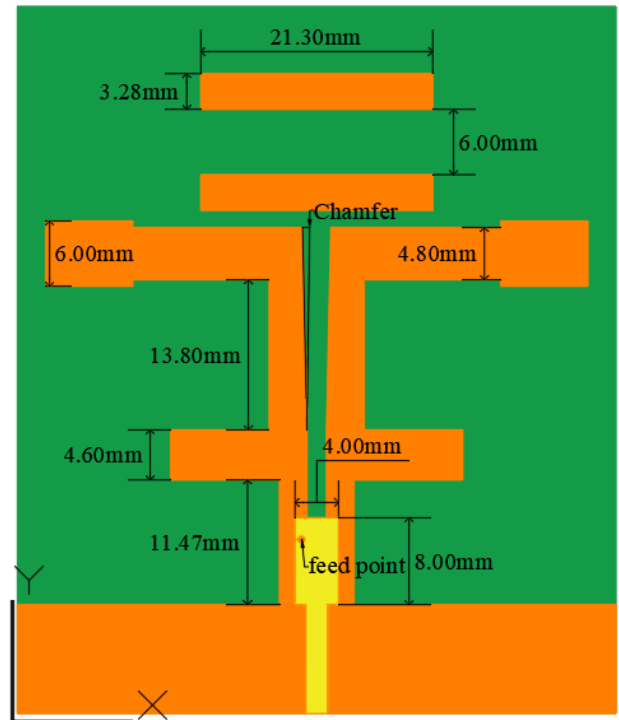
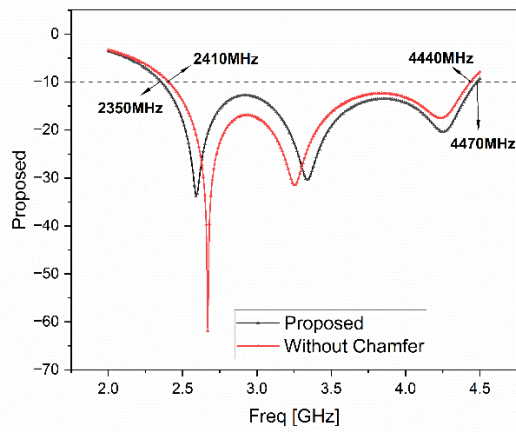


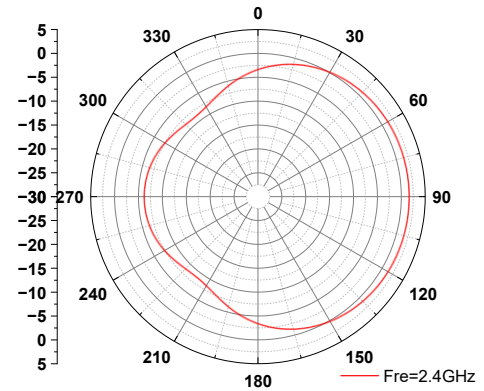
Figure 1. Layout of the proposed antenna

The quasi-Yagi antenna structure is illustrated in Figure 1. The antenna is fabricated on an FR4 substrate measuring  $65\text{mm} \times 55\text{mm} \times 1.15\text{mm}$ . Rectangular reflectors are positioned at the bottom of the antenna to enhance radiation performance. The driver section of the antenna utilizes two pairs of dipoles with different lengths and widths to achieve multi-frequency resonance. Chamfer is used on the part connecting the two pairs of drivers, improving impedance matching in the required frequency band. Two directors above the dipoles are used to enhance radiation performance and increase gain. The integrated balun was used to match the input impedance.

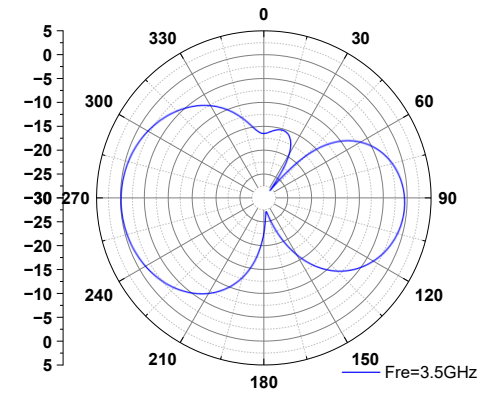


**Figure 2.** Simulated reflection coefficient

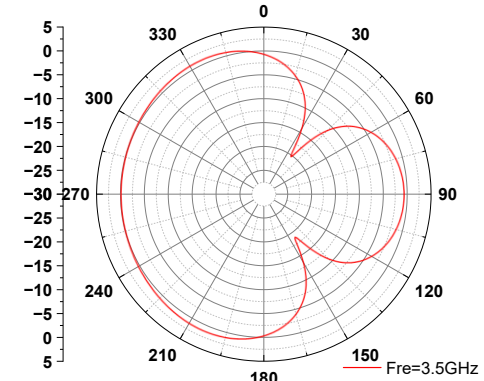
Figure 2 depicts the reflection coefficients exhibited by the antenna, both with and without the Chamfer. When the antenna is not chamfered, its operational frequency spans from 2410MHz to 4440MHz, rendering it incompatible with WLAN applications (2400MHz to 2484MHz). However, by incorporating chamfering into the antenna design, the enhanced impedance matching extends the bandwidth to encompass the range of 2350MHz to 4470MHz. Due to the excitation of different frequency radiation waves by two pairs of dipole antennas, their required line widths vary. By chamfering the antenna, the line width gradually changes from low to high, resulting in improved impedance matching in this section and broadening the operating bandwidth by 90 MHz. The improved antenna is capable of covering the operating frequency range of WLAN systems. The improved antenna design with varying line widths, achieved through chamfering, enables better impedance matching and expands the operational bandwidth by 90 MHz. This enhancement allows the antenna to cover the working frequency range of WLAN systems.



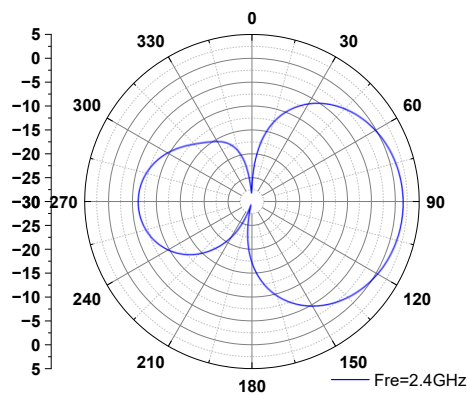
(b)



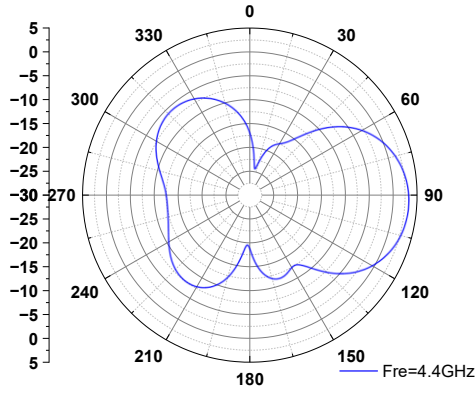
(c)



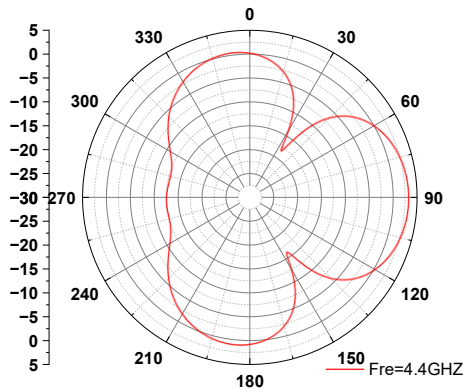
(d)



(a)



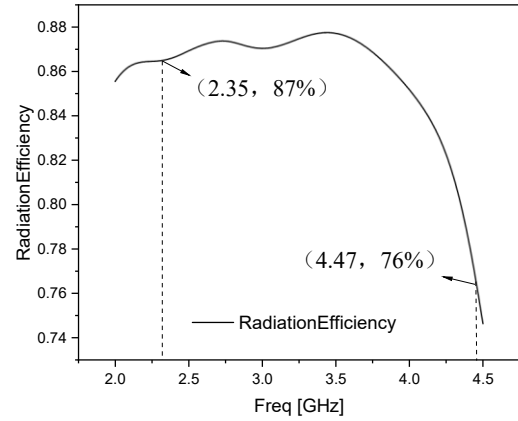
(e)



(f)

**Figure 3.** Radiation patterns of the proposed antenna. (a)XOY (b)YOZ (c)XOY (d)YOZ (e)XOY (f)YOZ

Figure 3 shows the radiation patterns of the proposed antenna at 2.4 GHz, 3.5 GHz and 4.4 GHz in E plane and H plane. The results indicate that the antenna exhibits a consistently high and stable radiation pattern. Furthermore, the antenna achieves a maximum gain of 3.23 dBi. This ensures good radiation performance of the antenna in its operating frequency band.



**Figure 4.** Simulated radiation efficiency

Figure 4 showcases the radiation efficiency of the proposed antenna, in the operating frequency range, as the operating frequency increases, although the radiation efficiency decreases the radiation efficiency remains consistently above 76%.

### III. CONCLUSION

This paper presents a broadband quasi-Yagi antenna structure with two branches. Stable radiation performance and reflection coefficient were attained through simulation. The proposed antenna exhibits suitability for WLAN (2.4 -2.484 GHz), n77(3.3 GHz-4.2 GHz) and n78(3.3 GHz-3.8 GHz) applications.

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