

Consideration of circular polarization of MACKEY

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1. Introduction

A small antenna, electrically powered, with sufficient robustness to metallic objects, named MACKEY basic type, has been proposed in this study. [1] In addition, MACKEY II, a reduced-thickness model, has been proposed [2]. By combining two MACKEYs, a new model for generating circularly polarized waves is developed in this study.

2. MACKEY design for circularly polarized waves

To radiate circularly polarized waves, a phase difference of 90° between two orthogonal, linearly polarized waves is required. An antenna that radiates linearly polarized waves is a standard MACKEY II. Therefore, two identical MACKEY IIs were combined in an orthogonal arrangement. The two antennas share a part of the grid plate as shown in Fig. 1. By powering the two electrical feed points with a 90° phase difference, circularly polarized waves can be observed to oscillate. In this study, a single port feed was used for each feed element.

The feed element is sandwiched in the middle of the AMC substrate, which has a thickness of 2 mm. Each of the two feed points shown in the fig.1 receives a current with a phase of 0° and 90° . Impedance matching is performed by varying the length ℓ of the feed element and the width g of the grid. The axis ratio was also adjusted by varying the slit width s . As a result, the width of the antenna board, denoted by L , is 81.2 mm and the length ℓ of the feed element is 29 mm.

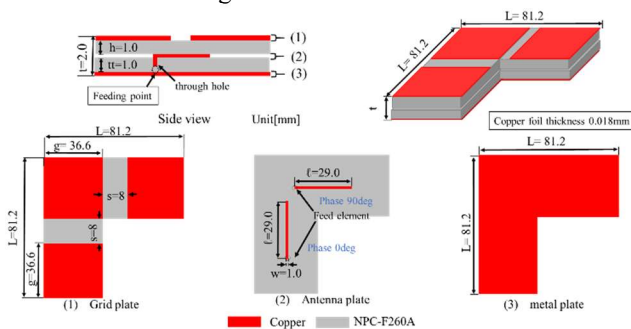


Fig. 1 Model diagram of circularly polarization MACKEY

3. Analysis results for of the model

Fig. 2, shows the results of analysis of VSWR and axis ratio. In both free space and on metal, the VSWR in the We-Fi 2 GHz band is less than 3 dB. In addition, in the Wi-Fi 2 GHz band, the axial ratio characteristics were less than 3 dB.

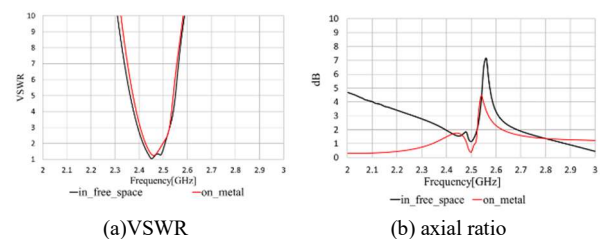


Fig. 2 VSWR and axial ratio diagram

The radiation pattern is shown in Fig. 3, with the high gain value of the RHCP indicating that the right circularly polarized wave is oscillating. Cross-polarization suppression is an aspiration for future improvement.

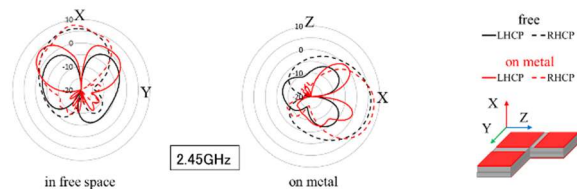


Fig. 3 VSWR characteristics

4. CONCLUSION

In this paper, a circularly polarized MACKEY is proposed. A small circularly polarized antenna operating in the Wi-Fi 2 GHz band with sufficient robustness to metals has been designed.

Acknowledgments

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References

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- [2] K.MIYASHITA et al, "MACKEY II model with reduced thickness," 2021 15th European Conference on Antennas and Propagation (EuCAP), pp1-4, Mar.2021

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