2-D arraying of 28-GHz MACKEY II

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1. Introduction

The recent development of the Internet of Things has led to the development of a meta-surface-inspired chip by KIT EOE Laboratory (hereafter referred to as MACKEY) [1]. In this study, we investigated the arraying of MACKEYs to improve gain and change directivity in wireless power transmission.

2. Consideration of MACKEY two-dimensional arraying

Fig. 1 shows a model diagram of the MACKEY II [2] for the WiFi 2.4 GHz band used in this study. In this study, the MACKEY II was continuously arranged along the two-dimensional direction and the spacing between elements was $\lambda/4$. Fig. 2 shows a model diagram of the two-dimensional array. The power was assumed to be supplied directly to the dipole antenna of the antenna plate shown in Fig. 2.

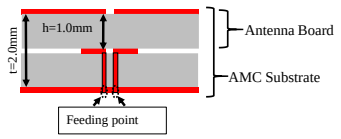

Fig. 1 Model diagram of MACKEY II.

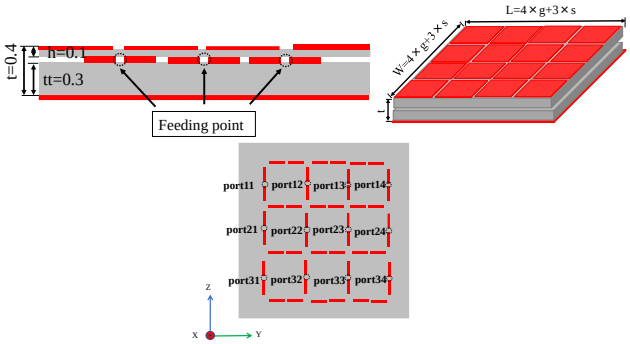

Fig. 2 Model diagram of the two-dimensional array MACKEY II.

3. Analysis Results

A slit width s of 3 mm was the matching limit in the one-element model. The larger the slit width s, the higher the gain when arrayed. However, the bandwidth of VSWR became narrower. After checking the impedance performance, we found that the imaginary part had a low value. Therefore, we varied the antenna length ℓ with a slit width s = 2 mm, which had a higher gain and wider VSWR bandwidth. When the antenna length ℓ was 2.35 mm, the bandwidth was wider and the gain was higher. Fig. 3 shows the gain when the antenna length ℓ was varied. Fig. 4 shows the VSWR characteristics. The gain in the frontal direction was 13.63 dBi.

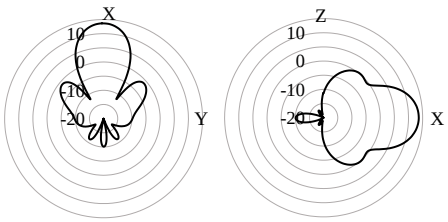

Fig. 3 Radiation pattern when slit width s is varied.

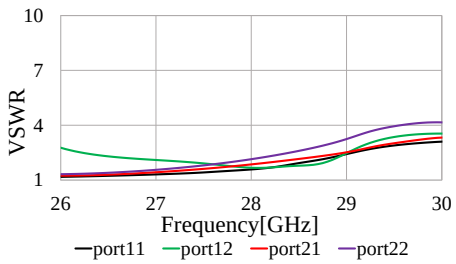

Fig. 4 VSWR characteristics when slit width s is changed.

4. Conclusions

In this study, we considered arraying in the 28 GHz band. It was observed that increasing the slit width improved the gain. The gain and directivity were higher than those of the conventional MACKEY, suggesting that arraying was effective.

Acknowledgments

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References

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[2] K. Miyashita, S. Makino, and K. Itoh, "Feasibility study of an unbalanced MACKEY type R with enhanced robustness on metal," in ISAP 2021, October 2021.

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