Basic Study of a Planar Rectenna Using Slot-Microstorip Line T-Junction

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1 Introduction

We have proposed planar differential rectennas to provide excellent conversion characteristics under low power conditions [1]. In this paper, a new planar rectenna which provides flexibility for rectifier design.

2 Structure

Fig. 1 shows the structure of the proposed rectenna. The rectenna consists of two microstrip antennas, a slot line, a schottky barrier diode and two chip capacitors. The antennas are connected by a microstrip line including two quarter-wavelength impedance transformers. As one of the capacitor is mounted on the slot line at $\lambda_g/4$ away from the crossover point of the microstrip and slot lines, it forms a slot-microstrip line T-junction. The other capacitor is mounted at $\lambda_g/4$ from the diode to make the slot line open at the diode. As all the circuit components are mounted on the reverse side of the rectenna, it provides design flexibility for rectifying circuits.

3 Experimental Results

Fig. 2 shows the measured conversion efficiency and optimum load resistance with respect to the input RF power density. The conversion efficiency is defined as the ratio of received RF power and output DC power. The measured conversion efficiency increases as the RF power density increases and the 35% efficiency is obtained when the RF power density is 0.22 W/m^2. On the other hand, the optimum load resistance decreases as RF power density increases. The optimum load resistance at the power density of 0.22 W/m^2 is 820 Ω.

Fig. 3 shows the measured frequency characteristics of the conversion efficiency when the RF power density and the load resistance are 0.22 W/m^2 and 820 Ω, respectively. The conversion efficiency better than 35% is obtained at the design frequency of 5.8 GHz. The rectenna design has not been optimized yet, but the feasibility of the rectenna using the proposed structure is confirmed.

4 Conclusion

A new planar rectenna using a slot-microstrip line T-junction has been proposed and experimentally examined. The proposed structure is expected to provide excellent design flexibility of rectifying circuits because all circuit components are mounted on the reverse side of the rectenna.

Acknowledgement

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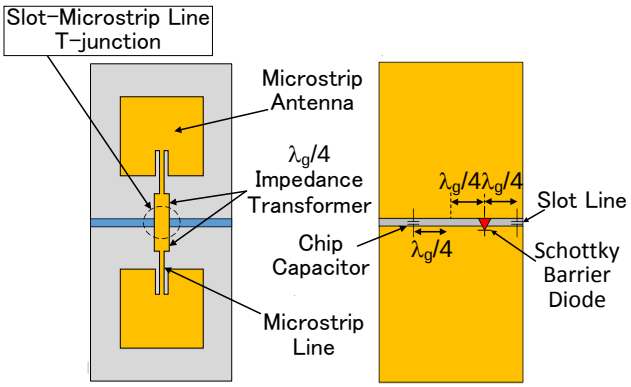

(a) Top View (b) Bottom View

Fig. 1 Structure of the proposed planar rectenna using a slot-microstrip line T-junction.

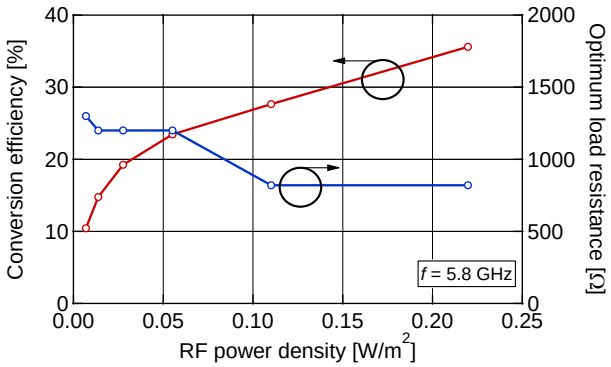

Fig. 2 Measured conversion efficiency and optimum load resistance vs. RF power density.

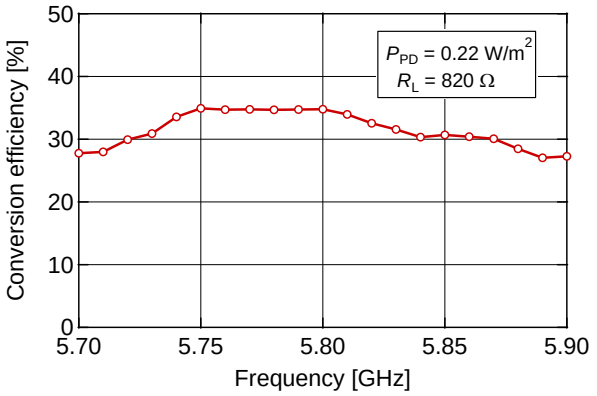

Fig. 3 Measured frequency characteristics.

References

[1] T. Sakamoto, Y. Ushijima, E. Nishiyama, I. Toyoda, and M. Aikawa, "Differential Mode Rectenna Array," in 2012 IEEE Antennas and Propag. Society Int'l. Symp. (APSURSI), 457.8, July 2012.