Development of a small-size and high-power rectenna for a wireless power distribution system in a building

Miyagawa Tetsuya
Laboratory of Space Radio Science, RISH, Kyoto University

As a new application of wireless power transmission technology, we propose a wireless power distribution system in a building. This system distributes electric power wirelessly through the closed space in the building. The closed space, which is composed of a deck plate and a flat plate, plays a role as a microwave transmission line[1)].

We described the necessity of a rectifier circuit that converts microwave power into 50W DC power. The size of the rectifier circuit is necessary to be smaller than 10^3. Next, we newly developed a small-sized and high-power rectifier circuit with a 16-way power divider. The experimental results showed that it had RF-DC conversion efficiency of 50% at an input microwave power of 18W. The size of the developed rectifier circuit was 112mm in length and 102mm in width. We also researched the relation between endurance and SPICE parameters of a diode, and derived requirement of the diode parameters for a high-power rectifier circuit. We described limitation of a small-sized high-power rectifier circuit, when a conventional rectifier circuit is expanded on a plane surface.

Next, we newly developed and examined a 3D rectifier circuit.
With respect to the 3D circuit composition, the loss of a vertically-connected-type circuit was small. When the interval between the adjacent substrates was 5mm or more, the characteristic impedance was not affected. Then, we developed a small-sized and high-power rectifier circuit with a 64-way power divider, composed of a 8-way wilkinson power divider and 8rectifier circuits with a 8-way power divider. The rectifier circuit with a 64-way power divider provided 55% RF-DC conversion efficiency at an input microwave power of 100W. The size of the rectifier circuit was 125mm in length, 110mm in width and 95mm in height.

Finally, we demonstrated practical examinations of a receiving adapter.
This adapter converted 100W input into about 40W DC output, even if the load of the adapter output was replaced. It could be operated for about three hours at 100W microwave input.

REFERENCES

[1] Adachi Tatsuhiko, Development of a wireless power distribution system in a building (in Japanese), Master thesis of Kyoto University, 2006