

SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies, Experiments and Demonstrations (2)

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IMPROVED PERFORMANCE OF A RECTENNA ARRAY FOR WIRELESS POWER
TRANSPORTATION

Abstract

Wireless Power Transportation (WPT) technology aims to eliminate the cable connections conventionally necessary for transmitting electricity. The newly successful test results lead the way to applying the technology in numerous terrestrial and space fields. Mitsubishi Heavy Industries, Ltd. (MHI) has recently revived the interest for WPT with a ground-based demonstration testing of a WPT system. This is expected to be the power generation systems of the future (System Solar Power Satellite - SSPS). This approach offers the advantages of permanent exposition to a much higher level of incident power compared to the ground. Theoretically, this project showed that WPT would reach efficiencies close to 100% provided by a perfectly design projector and collector.

Since 1996, after the Grand Bassin (Reunion Island, Le Tampon) case study, extensive researches have been carried out by the LE2P laboratory from the University of La Réunion. The LE2P addresses this inherent challenge from several aspects and more precisely on the efficiency of the receiving element (the rectenna: rectifying antenna).

The study presented here focuses on the design of a simple and compact rectenna to enhance the performance at a relatively low collect power level. Although a single narrow-band design is conducive enough to achieve high efficiency, we know that the amount of the DC output power is limited. To overcome this issue, one solution would be a rectenna array designed for collecting more HF power to produce more DC power. The opportunity in this study is to collect the low energy densities at the edge of a rectenna array. To estimate the DC power delivered by a rectenna array, we started with the study of a 2x5 planar array of small metamaterial-inspired antennas. Each antenna incorporates its own rectifier to collect DC power and is assembled in series manner. The size of the overall rectenna array is 11*9cm². Finally, our most recent studies show an increase of the collected DC voltage with the presence of a reflector to the back of the rectenna array.