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

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SANDWICH MODULE OPTIMIZATION FOR SPACE SOLAR POWER

Abstract

Solar power satellites are proposed as a source of energy for terrestrial use. Architectures suggested vary in orbit selection, means of wireless power transmission, and energy generation method; though most have focused on the combination of geosynchronous orbit, microwave wireless power transmission, and photovoltaics. Recent approaches emphasize highly modular schemes to exploit improved economies of scale inherent in mass production. A key element in many of these architectures is the sandwich module, which performs in its layers three functions: sunlight-to-DC conversion, DC-to-microwave conversion, and microwave radiation. A sandwich module prototyping and testing effort provided insight into how these layers are integrated to address thermal concerns, and offered possible avenues for optimization of the layers and the module as a whole given state-of-the-art efficiency and performance constraints. Matching of solar array characteristics with electronics performance at expected operating temperatures and under projected solar illumination levels proved critical. Because of the layer interdependence of parameters such as efficiency, output power level, and operating temperature, modeling expected performance of an actual hardware implementation is challenging. Accordingly, the ability to test an integrated sandwich module while maintaining access to the separate interfaces between layers, under space-like environmental and illumination conditions, was important in allowing for the determination of optimal operating points. These results may be generalized to modules employing similar architectures. Suggestions for future areas sandwich module research are delineated.