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SPACE POWER SYMPOSIUM (C3)
Space-Based Solar Power Architectures / Space & Energy Concepts (1)

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SYSTEM STUDY OF MODIFIED TETHERED SPS AND SCENARIO OF SPACE DEMONSTRATIONS

Abstract

The Space Solar Power System (SSPS) converts solar energy into electricity in space, and transmits energy by wireless power transmission (WPT) system from space to the ground. Long distant WPT systems from orbit using S band and C band microwaves have been studied and developed. Frequencies of WPT are decided from the viewpoint of propagation loss through the atmosphere. Requirements of WPT for SPS are as follows.

1. Transmission distance: 36,000km (through ionosphere and atmosphere)
2. Size of transmitting Antenna: Several km (for S or C band)
3. Microwave beam accuracy: less than 0.001 deg.
4. Transmitting Power: GW

Tethered SPS consists of an enormous number (2,375,000) of power generation and transmitting panels with the size of 5 m x 0.5 m x 0.02 m that are independent electrically. To achieve the precise beam control, JAXA and Jspacesystems had been studied and developed a direction finding and beam control system and conducted WPT demonstration experiment utilizing the phased array antenna system. However, tethered SPS has some issues. Small gain of a receiving antenna of pilot signals results a requirement of high power up link of the pilot signals. Also, degradation of microwave beam control accuracy caused by the deformation of the large-scale antenna will be caused. Compensation methods will be required for the antenna deformation. Review of the WPT system of the tethered SPS was carried out applied the improved software retro-directive system, and system study on the modified tethered SPS was performed. Results of the system study and scenario of the space demonstration experiments for the modified tethered SPS will be presented.