

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

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WPT EXPERIMENTS FOR SOLAR POWER SATELLITE

**Abstract**

Solar power satellite (SPS) that generates electricity in orbit and transmits energy using microwave from space to the ground has been expected to be a candidate of the future sustainable power system. Wireless power transmission (WPT) from space to the ground is one of the major and inherent technical issues toward the SPS. Requirements for the practical SPS such as the tethered SPS that was designed by JAXA are as follows.

1. Very large scale transmitting antenna with a size of 2-3 km will be required.
2. Transmitting antenna consists of millions of rigid panels and hundreds of millions of antenna elements.
3. Long distance power transmission of 36,000 km will be required with directional control accuracy of sub millidegree. Pilot signals will be used for direction detection of the rectenna site.
4. High DC to RF conversion efficiency of 70-80
5. Very light weight system is required.

We manufactured a WPT demonstration system that consisted 16 antenna panels and 16 phase control units. We carried out WPT experiments. C band microwaves were used for power transmission, and L band and S band microwaves were used for the pilot signals. We compared the direction detection system using the pilot signal between the amplitude method and the phase comparison method. Microwave beam control accuracies were evaluated under the several deformed conditions of the phased-array antenna panel. Also, we developed a phase control and amplification circuit with a high efficiency power amplifier based on harmonic manipulation. Efficiency, gain and output power of the amplifier is above 70 %, 10 dB and 34 dBm for 5.7 GHz, respectively. We evaluate a current technology level on above requirements of WPT toward SPS.