BEAM CONTROL SYSTEM WITH SPREAD SPECTRUM PILOT SIGNALS FOR SOLAR POWER SATELLITE

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ABSTRACT

SPS (Solar Power Satellite) is one of the most important and clean power sources to solve global warming and energy problems. This system transmits electric power generated by solar cells in space through microwave. The microwave power is sent to a power-receiving site on the ground or in space. The retrodircetive array is generally used for transmitting the power correctly to the receiving site. We propose a new direction finding system to be used for a microwave power transmission system, which can send the power to multiple directions. Power receiving sites send pilot signals and high power microwave beams are sent to arrival directions of the signals. In the present paper, the spread spectrum (SS) modulation is used for the pilot signals to differentiate them. This system is a kind of software retrodirective array. Pilot signals are sent from power receiving sites. Based on the information of the arrived signals, the array patterns can be synthesized for a single or multiple beams, sidelobe suppression, etc. The power could be sent to the directions of the pilot signals. The conventional hardware retrodirective system is fast, but complex and the adjustment of the system is difficult. Although this system is not as fast as the hardware system, this has flexibility. Because the direct sequence spread spectrum is used for the signals, this does not respond to fake or wrong signals and is expected to be more reliable under noises and the power transmission. The pilot signal can be modulated e.g. for sending information on power reception and authentication. This is a useful technique even for a single receiving site. It is confirmed that the new direction finding system for multiple spread spectrum pilot signals works well.

Phase differences can be measured by despreading the SS modulated signal. The MUSIC method is also examined. It is clarified that it is simpler but two signals cannot necessarily be identified when their distance or directions are close. It is not appropriate to set antennas for receiving the pilot signal(s) in the ends of large transmitting array since the distance between the antennas cannot be so large. Since substitution of some transmitting antennas to the receiving antennas could increase sidelobe levels, receiving antennas are shared with some transmitting antennas. Interference of the transmitter to the receiver and its affect to the performance of the phase difference measurement are evaluated.

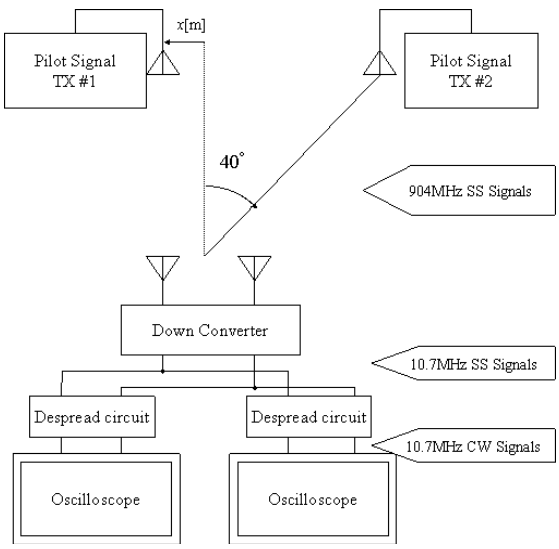

Fig. 1 (Left) Experimental setup for the SS pilot signal.
Fig. 2 (Below) Errors of the phase difference between the two antennas.