

# **A self-steering array and its application to phase synchronization of transmitter units and SPS**

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## **INTRODUCTION**

In a huge phased array system like SPS (Solar Power Satellite), it is impossible to supply a reference phase from one single oscillator. A phase in each array or unit composed of a set of arrays must be synchronized although the frequency synchronization is rather simple. This paper shows that such synchronization can be attained from an application of a self-steering array.

## **SELF-STEERING ARRAY**

SHARP (Stationary High Altitude Relay Platform) is a platform consisting of an aircraft powered by microwave energy sent from the ground [1]. A unique self-steering array which automatically tracks the receiver (the spacecraft) by adjusting phase shifters by  $\pm 90^\circ$  based on its altitude and the reception intensity on the ground was used. We propose a revised system which does not require the altimeter and converges faster. This system changes the phase shifters by  $0^\circ$  and  $180^\circ$  in addition to the  $\pm 90^\circ$  shifts.

## **PHASE SYNCHRONIZATION**

When a system is so large like SPS, the array will be composed of a lot of units. The system is too large to distribute a reference signal generated by a single reference oscillator. Although the beam steering is possible in each unit, a beam radiated from a unit could cancel that of another one depending on the phases of their reference signals. If independent oscillators are used, their requirement for the stability and accuracy could be quite strict. Although their frequency can be synchronized, it would be difficult to adjust the phases. The phase of each reference oscillator could be adjusted using the self-steering technique if each unit works under its own retrodirective system.

## **RESULTS**

The revised system converges faster with no altimeter. It can be demonstrated that phases of a reference signal in each unit can be synchronized by the proposed method.

## **REFERENCES**

- [1] Thomas W. R. East, A Self-Steering Array for the SHARP Microwave-Powered Aircraft, IEEE, Transaction on Antennas and Propagation, vol. 40, no. 12, 1565-1567, December, 1992.