# Optimization of uniformly excited phased array and spread spectrum pilot signal for microwave power transmission

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## 1. Uniformly excited phased array

For reduced sidelobes and efficient energy transmission, 10-dB Gaussian tapering, where the energy density of the central part of antenna array is stronger than the edge so that 90% of the output power may be concentrated in the power reception site, has been proposed for its transmitting array antenna for SPS (solar power satellite). This causes a problem on the thermal design since elements at the array center are excited most strongly than those near the edge. Antenna radiation patterns are optimized for high transmission efficiency and low sidelobes under a uniformly excited array in order to solve the problem [1]. The radiation pattern with uniform amplitude excitation for the beam formation subsystem of 12 x 12-element array of SPORTS 5.8 [2] was optimized as a small-scale proof experiment under the assumption that the software retrodirective system will be adopted in a future SPS. The objectives of the multipurpose optimization were to maximize the power in the reception area and to minimize the MSLL (maximum sidelobe level) simultaneously. The radiation patterns that suppress MSLL with high reception power were obtained and the results were experimentally confirmed. The MSLL were suppressed by about 6.6 dB compared with in-phase excitation. It is expected that mutual coupling is hardly influenced when the element interval was 0.6 wavelength in the array antenna element spacing of square patch antennas since the experimental and calculated results matched well as shown in Fig. 1.

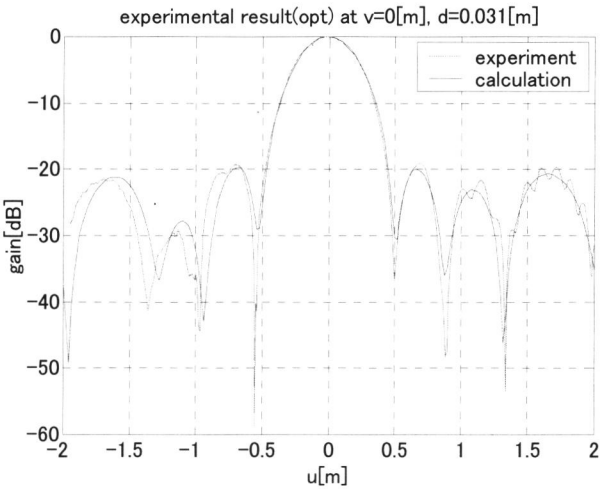


Fig. 1, Example of calculated and experimental phased pattern.

## 2. Spread spectrum pilot signal

Although the pilot signal without modulation have usually been used in the DOA (direction of arrival) estimation, it has been proven by an experiment that the selection of the multiple pilot signals are possible using the spread spectrum pilot signals and that the frequency of the pilot signal in the same band as the microwave power transmission frequency can be used [3]. Though it had to utilize until now different frequency bands for the energy beam and the pilot signal and two frequency bands became a problem nowadays since the frequency resources are tight. This study shows some hope of solving the problem. In addition, the formation of the microwave power transmission beam to the multiple points was also easy by selecting them using the spread spectrum pilot signals.

## References

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