Measurement of Reflection Coefficient at Surface of Reflectarray

Yuhao Shang Hiroyasu Sato Qiang Chen
Graduate School of Engineering, Tohoku University

1. Introduction In order to evaluate the reflection coefficient at the surface of a reflectarray (RA), the far field measurement has been used which required a large-size measurement system. In this report, a near field measurement is presented to evaluate the complex reflection coefficient distributions by measuring standing wave.

2. Mesurement system A measurement system is shown in Fig. 1. A horn antenna is located on the axis of a lens. Reflectarray with periodical structure in y-direction and with same structures in x-direction, is fixed on XY-actuator. A small dipole antenna is scanned along z-direction by Z-actuator. A horn antenna is located at focal plane of lens and the uniform field distributions in a region of RA are realized.

3. Method and results Incident wave and reflected wave forms a standing wave in a region between lens and reflectarray and were measured by a small dipole antenna. The standing wave ratio is obtained by the maximum and the minimum values of the magnitude of the near-field distributions and then absolute values of the reflection coefficient can be obtained. Standing waves in cases of a conducting plate and a reflectarray are shown in Fig. 2. The absolute values of reflection coefficient are calculated using the values of peaks and nulls, respectively. Then the amplitude of the reflection coefficient can be calculated as:

$$\mathrm{VSRW} = \frac{E_{\max}}{E_{\min}} \qquad |\Gamma| = \frac{\mathrm{VSRW}-1}{\mathrm{VSRW}+1}$$

The phase of reflection coefficient can be calculated from the difference in distance between two nulls of each standing wave as:

$$\phi = \pi \mp 2k(p_2 - p_1) \qquad \Gamma = |\Gamma| e^{j\phi}$$

-: $(p_2 - p_1)$ toward source +: $(p_2 - p_1)$ toward load

The amplitude and phase distributions of reflection coefficient along y-axis (x=0) are shown in Fig. 3. Large phase and amplitude changes were observed in case of x=0 which will be corresponding to the structure of RA in y-directions.

3. Conclusion This report provided a method to measure the distribution of amplitude and phase of the reflection coefficient at the surface of reflect array using the standing wave. The improvement of measurement systems will be performed in a recent future.

ACKNOWLEDGMENT

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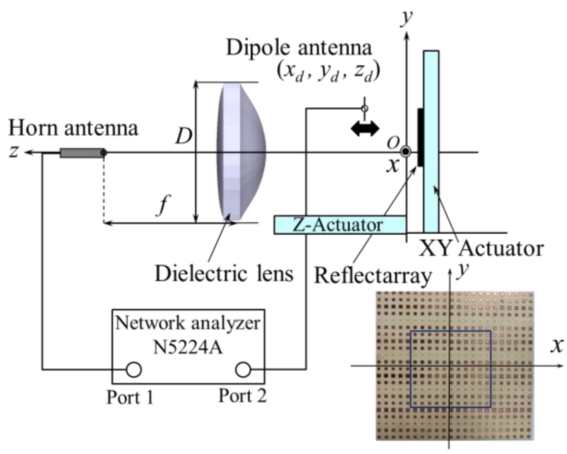

Fig. 1. Measurement system with small dipole antenna and lens.

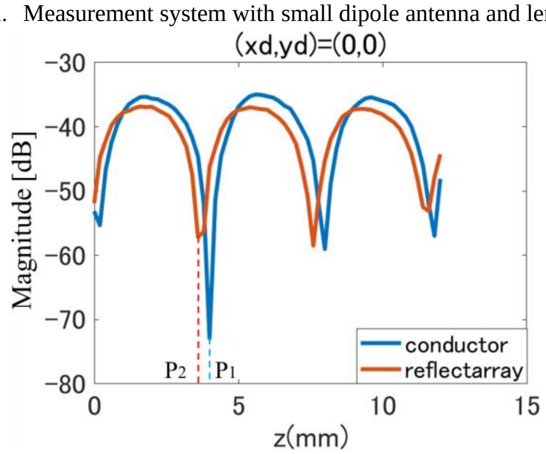

Fig. 2. Standing waves formed by conducting plate and reflectarray

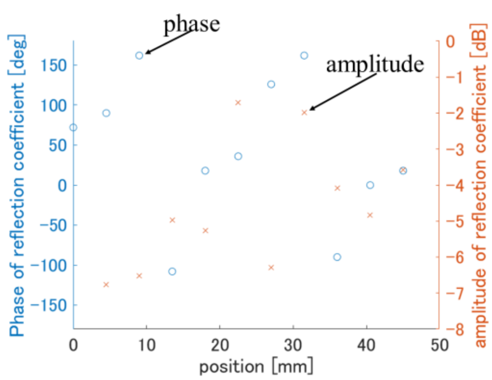

Fig. 3. Phase and amplitude distributions of reflection coefficient. 37.5 GHz.