Fabrication of an 80GHz-band 16×16-element 45-deg. Linearly-polarized Antenna by Diffusion Bonding of Thin Aluminum Plates

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This paper presents the fabrication of an 80GHz-band 16×16-element 45-deg. linearly-polarized waveguide slot array antenna by diffusion bonding of laminated thin aluminum plates, in order to reduce the weight. It is about 1/3 of that of the copper antenna with the same structure. The copper antenna had a corporate-feed waveguide on the bottom layer and radiating elements on the top layer (T.Tomura et al., IEEE Trans. Antennas Propagat., 62(10), 5061-5067, 2014). The aluminum antenna has the same structure to the cupper one except for the slot-plate thickness changing from 0.2mm to 0.1mm due to the present fabrication of the aluminum thin plates. It has not been redesigned by including this change at this moment. The thicknesses for the waveguides and the cavities are unchanged.

Fig.1 shows the picture of the aluminum antenna. Aluminum alloy 6063 is used to have high conductivity. Its standard conductivity is $3.2\text{x}10^7$S/m. The size is 60.8mm x 60.8mm x 2.8mm and the weight is 18g. Fig.2 shows the frequency dependences of the directivity and the gain. The difference between the directivity and the gain corresponds to the losses by the reflection and the aluminum. It is about 0.5dB in the simulation. At this moment, we have a problem in a texture to connect the antenna and a waveguide in the measurement, so that the measured directivity is only shown in Fig.2 by estimating from the near-field distribution. The measured directivity is 32.9dBi with the aperture efficiency of 85.8% at 78.5GHz. The amplitude deviation is about 4dB in the measured near-field distribution. The measured frequency dependences of the reflection and the gain will be shown in the conference.

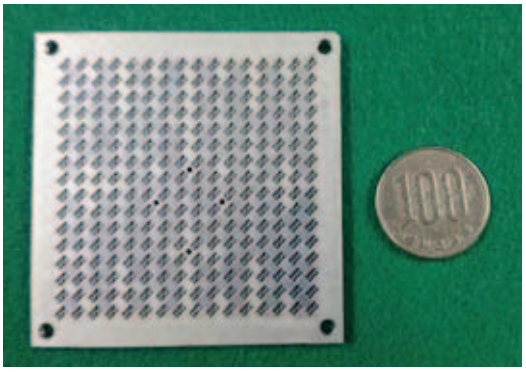

Fig.1 Picture

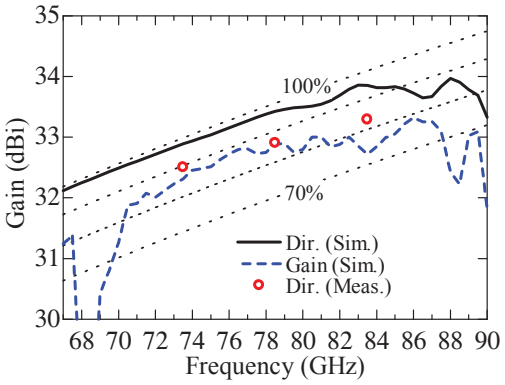

Fig.2 Directivity and Gain