2D conformal wideband phased array antenna system

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Phased array antennas have been used in many military and civil applications such as radar, EW, and wireless communications[1]. Especially, wideband phased array antennas with conformal structure are actively studied[2,3]. The conformal array antenna should have a structure suitable for mounting on aircraft and high-speed air vehicle to reduce air resistance. Therefore, it is designed to be low profile to integrate into such non-planar structures. Wideband antennas such as TSA's(Tapered Slot Antenna), LPA's and spiral antennas, are difficult to apply to conformal array antennas since their high height or large area. Recently, TCDA has been proposed to have large bandwidth with low profile. However, it has been designed only on planar ground plane[4].

In this presentation, a modified spiral antenna was used that is as small as 0.2 wavelength at 2 GHz in order to prevent grating lobes that may occur in wideband array antenna. In addition, a low-profile structure applicable to the conformal shape is realized by using a miniaturized balun and a ground plane reflector. Next, a Wideband beamforming network is constructed to control the magnitude and phase of the signal to be input to the 24 antenna elements. The wideband power divider was designed in a 3 section wilkinson structure to be able to operate at a frequency of 2 to 6 GHz and implemented in 24-way. A 7-bit true-time delay circuit was implemented with a minimum delay time of 8 ps and a maximum delay time of 1016 ps for beam steering in the broadband. The total RMS error of the measured delay time is 1.6%. The Least Squares Method (LSM) algorithm was used for the beam pattern synthesis of the conformal array antenna. The measurement results of the 2-dimensional wideband conformal array antenna system show that the steering angle error is less than 3 degrees and the PSLL is less than -10 dB are with maximum steering angle of 30 ° within 2 ~ 6 GHz band. The design details will be presented and discussed at the symposium.

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