

Measurement of Vertically Polarized Omnidirectional Reflector Antenna Fed by a Circular Waveguide Bent TM_{01} Mode Converter for the 150 GHz Band

Jiro Hirokawa⁽¹⁾, Riki Yanagisawa⁽¹⁾, Takashi Tomura⁽¹⁾, and Issei Watanabe⁽²⁾

(1) Institute of Science Tokyo, Tokyo 152-8552, Japan (jiro@ee.e.titech.ac.jp)

(2) National Institute of Information and Communications Technology, Tokyo 184-8795, Japan

A vertically polarized horizontal-plane omnidirectional antenna with a circular waveguide bent TM_{01} mode converter (L. G. Shen, and Z. J. Juan, Chinese Phys. Lett., vol. 18, no. 9, pp. 1285-1287, 2001.) and a rotationally symmetric single reflector, which can be fabricated in the terahertz wave band above 100 GHz, is designed, fabricated and measured for the 150 GHz band as shown in the left of Fig. 1 (J. Hirokawa, R. Yanagisawa, and T. Tomura, Euro. Conf. Antennas Propag., A06-1, Mar. 2023.). Two circular bends of the same shape are connected in opposite bending directions to feed power from the bottom of the antenna, so that the flange of the feeding waveguide does not disturb the omnidirectional radiation pattern. A frequency range of 147.8 GHz to 170.0 GHz is determined as the operational band, where the simulated transmission coefficient ratio of the TE_{11} mode to the TM_{01} mode is less than 1/3 that in the designed mode converter. The main beam direction $\theta = 88$ degrees and the 3 dB beam width is 19 degrees in the simulated radiation patterns in the vertical plane at the design frequency of 158 GHz. The measured frequency characteristic of the coefficient is -36.6 dB at 158.2 GHz and less than -11.7 dB in the band. The right of Fig. 1 shows the measured radiation patterns in the horizontal plane at 134 GHz, 146 GHz, 158 GHz, and 170 GHz. The circumferential amplitude deviations are 1.7 dB, 1.3 dB, and 3.1 dB at 146 GHz, 158 GHz, and 170 GHz, respectively. The angular gain variation at the measured frequencies in the band is 4.9 dB at the maximum in the fabricated antenna in the band. The realized gain is in a range of 2.2 dBi to 8.8 dBi in the band. This work is supported in part by the Ministry of Internal Affairs and Communications, Japan, under Grant JPJ000254.

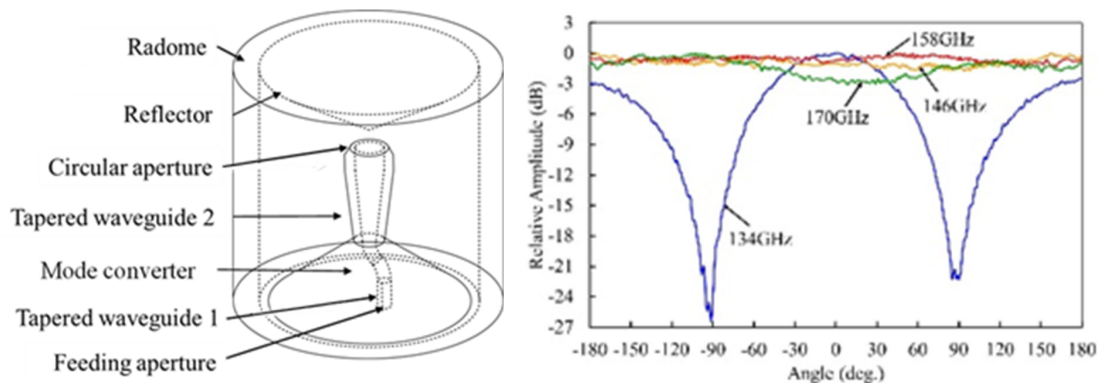


Figure 1. Antenna structure (left) and measured radiation patterns in the horizontal plane (right).