

Comparison of Return Loss Measurement Method of 60 GHz Band 2×2 Patch Array

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The millimeter wave band is expected to be applied to ultrahigh-speed wireless communications because of its wider bandwidth than the microwave band. Among the millimeter-wave bands, IEEE802.11ad standards have been standardized and products are now available in the market. In this paper, we report the results of a study on the difference of S-parameters due to the difference of measurement methods between probe and coaxial measurements using a 60 GHz patch-array antenna.

Figure 1 shows the structure of the 2×2 patch array antenna using a multilayer substrate. The antenna consists of two stacked patch element and arranged in a 2×2 array. The total thickness of the substrate is 0.65 mm. The feed port is located at the $-y$ edge, and in the case of type1, the same amplitude and phase feed are applied to each element. The element antenna spacing dx and dy were both 3.0 mm ($0.6 \lambda_0$ @ 60 GHz). Figure 2 shows photos of the prototype 2×2 patch array antenna. Two different feed lines, type1 and type2, were measured. In the case of type2, the feed phase has 180° with respect to the x direction. Figure 3 shows the measurement and simulation results of the probe and coaxial connector measurements of the return loss for type1 and type2. In type1, there is a large discrepancy between the return loss measured by the two measurement methods. The return loss of the coaxial connector measurement method is larger in the frequency band below 50 GHz, while it is smaller in the frequency band above 50 GHz. The measured return loss is generally larger than the simulation results. Similarly in type2, return loss of the coaxial connector measurement method is larger in the frequency band below 50 GHz, while it is smaller above 50 GHz. Compared to the simulation results, the measured return loss is larger. However, return loss rises for the probe measurement method and return loss drops for the coaxial measurement method around 55 GHz, respectively. These results indicate the probe measurement method is closer to the simulation results.

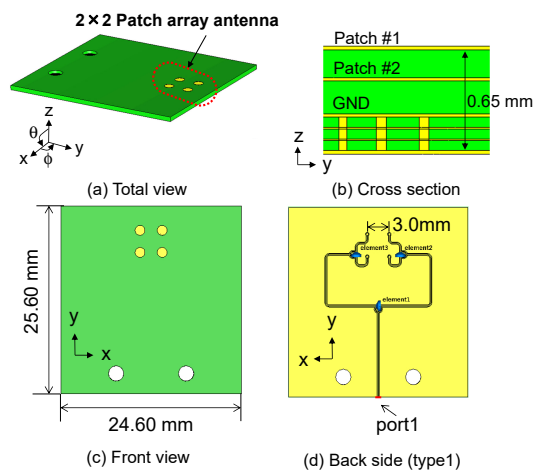


Figure 1: Total structure of the 60 GHz band 2×2 patch array antenna.

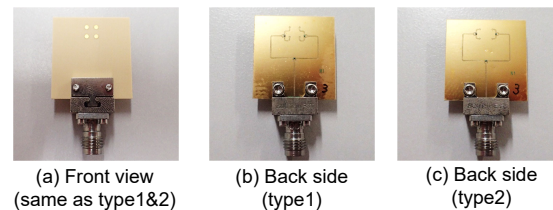


Figure 2: Photos of the fabricated antenna.

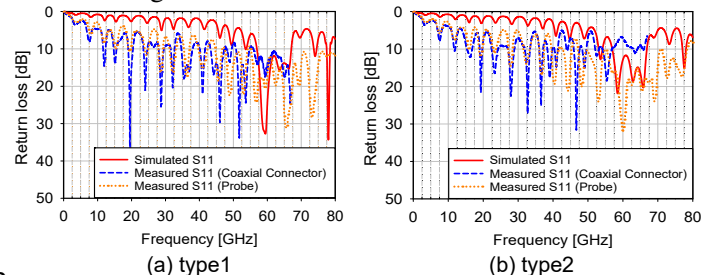


Figure 3: Comparison between measured and simulated return loss.

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