V133a Experimental Study of Silicon Membrane Based Superconducting Waveguide-to-CPW Transitions

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For heterodyne imaging array applications, we have demonstrated fully functional superconductor-insulator-superconductor MMIC mixers at 2 mm wavelengths. The demonstration and related development work were continuously reported in ASJ annual meeting 2019 Spring, 2020 Spring, and 2021 Spring. In the MMICs, silicon-membrane-based planar probes (rectangular waveguide to coplanar waveguide transitions, for short, Wg-to-CPW) are of the most importance in achieving high efficient signal coupling. In the present work, we aim to evaluate the planar probe as a standalone component and investigate its bandwidth potential. We have reported the design of a full-height waveguide transition which covers $125 - 211\,GHz$, more than 50% fractional bandwidth in 2021 Spring ASJ annual meeting. Since then, this design was tested by using a back-to-back (B2B) probe pair. The experiment study was carried out by performing cryogenic measurement of the transmission of the B2B probe pair with mm-wave network analyzer. On the other hand, the B2B test module were simulated by using electromagnetic field simulator with taking consideration of superconducting transmission line properties. Reasonable agreement of the measured results and the simulated one has been achieved and will be reported in this meeting. The agreement indicates that the membrane-based Wg-to-CPW transitions are reliably realized in MMICs. This is the main achievement of this study.