V125a Noise Breakdown of Dual-polarization Balanced MMIC SIS Mixer at $2\,mm$ Wavelength

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We have been developing an innovative approach to enable compact focal plane heterodyne detector arrays with SIS mixers for wide field-of-view astronomical observation at mm and sub-mm wavelengths.The new scheme is characterized by the adoption of superconducting monolithic microwave integrated circuits (MMICs), on which substantially larger scale circuitry can be accommodated than traditional quartz SIS mixers. We have demonstrated full functioning of such devices with reasonable performance in previous annual meetings. In particular, the DSB noise temperature measured at $2\,mm$ wavelength is around $40\,K$, which is not very unreasonable allowing for much more complicated on-chip circuit than quartz SIS mixers but still not as good as state-of-the-art at this wavelength. For example, ALMA Band 4 SIS mixers shows averagely $< 25\,K$ DSB noise temperature estimated from about $50\,K$ SSB noise temperature. To understand the noise performance of the MMIC SIS mixers, we have been investigating various noise sources that compose the overall $40\,K$ noise including the on-chip transmission loss, the RF loss of the optics path in the measurement setup, and the linearity of the measurement system. In this talk, we would like to report the results of this investigation and present more accurate noise measurement results.