About effect of the temperature operating conditions on the Noise Temperature and Noise Bandwidth of the Terahertz Range NbN Hot-Electron Bolometers.

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Abstract—Results of an experimental study of the noise temperature (Tn) and noise bandwidth (NBW) of the superconductor NbN hot-electron bolometer (HEB) mixer as a function of its temperature (Tb) and NbN bridge length are presented. It was determined that the NBW of the mixer is significantly wider at temperatures close to the critical ones (Tc) than are values measured at 4.2 K. The NBW of the mixer measured at the heterodyne frequency of 2.5 THz at temperature Tb close to Tc was ~13 GHz, as compared with 6 GHz at Tb = 4.2 K. This experiment clearly demonstrates the limitation of the thermal flow from the NbN bridge at Tb ≪Tc for mixers manufactured by the in situ technique. This limitation is close in its nature to the Andreev reflection on the superconductor/metal boundary. In this case, the noise temperature of the studied mixer increased from 1100 to 3800 K.