# On-wafer Characterization of Frequency Conversion Properties in an SIS Tunnel Junction



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## Motivation

An SIS junction has been used as a low-noise down converter at (sub-) millimeter wavelengths for a long time. In resent years, novel applications of the SIS junction based on its superior properties are proposed:

### **GHz frequency converter for TES readout**





#### **Frequency up converter for multiplexing**

## **RF:** ~30 GHz IF: ~5 GHz Wideband amplifier

## **Measurement setup**

Cryogenic probe station Operating temperature: 4.0 K (GM mechanical Cryocooler) VNA Frequency range: DC-50 GHz





Probe (IF)



=> Essential to characterize SIS frequency conversion properties. However, there has been few reports below 50 GHz, especially, on an SIS up converter. At microwave frequencies, on-wafer characterization can be applied, which allows us to directly extract device parameters and to evaluate the device performance.

## **Device parameter extraction**

Device under test

• Equivalent circuit model

*Quantum admittance* 

Input port



### **Frequency converter characterization**









This work was supported by JSPS KAKENHI Grant Numbers 18H03881 and 19H02205.

