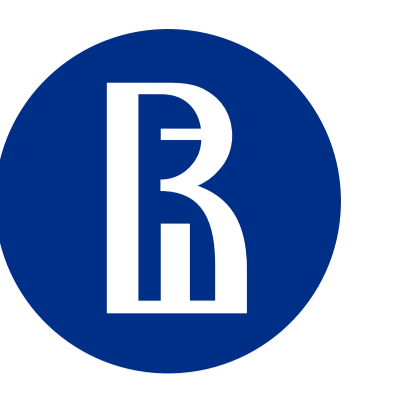
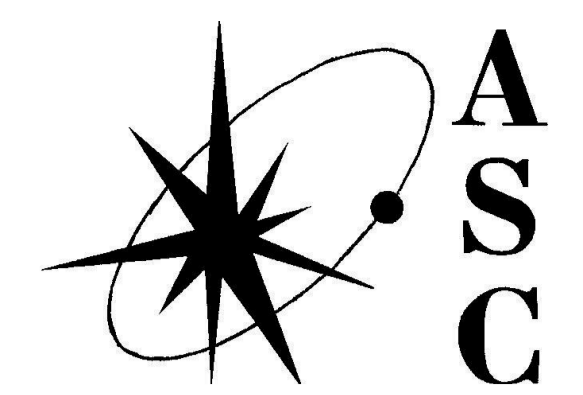


DEVELOPMENT OF THE RF WAVEGUIDE BLOCK FOR A SIDEBAND SEPARATING SIS RECEIVER OPERATING IN 210–270 GHz BAND



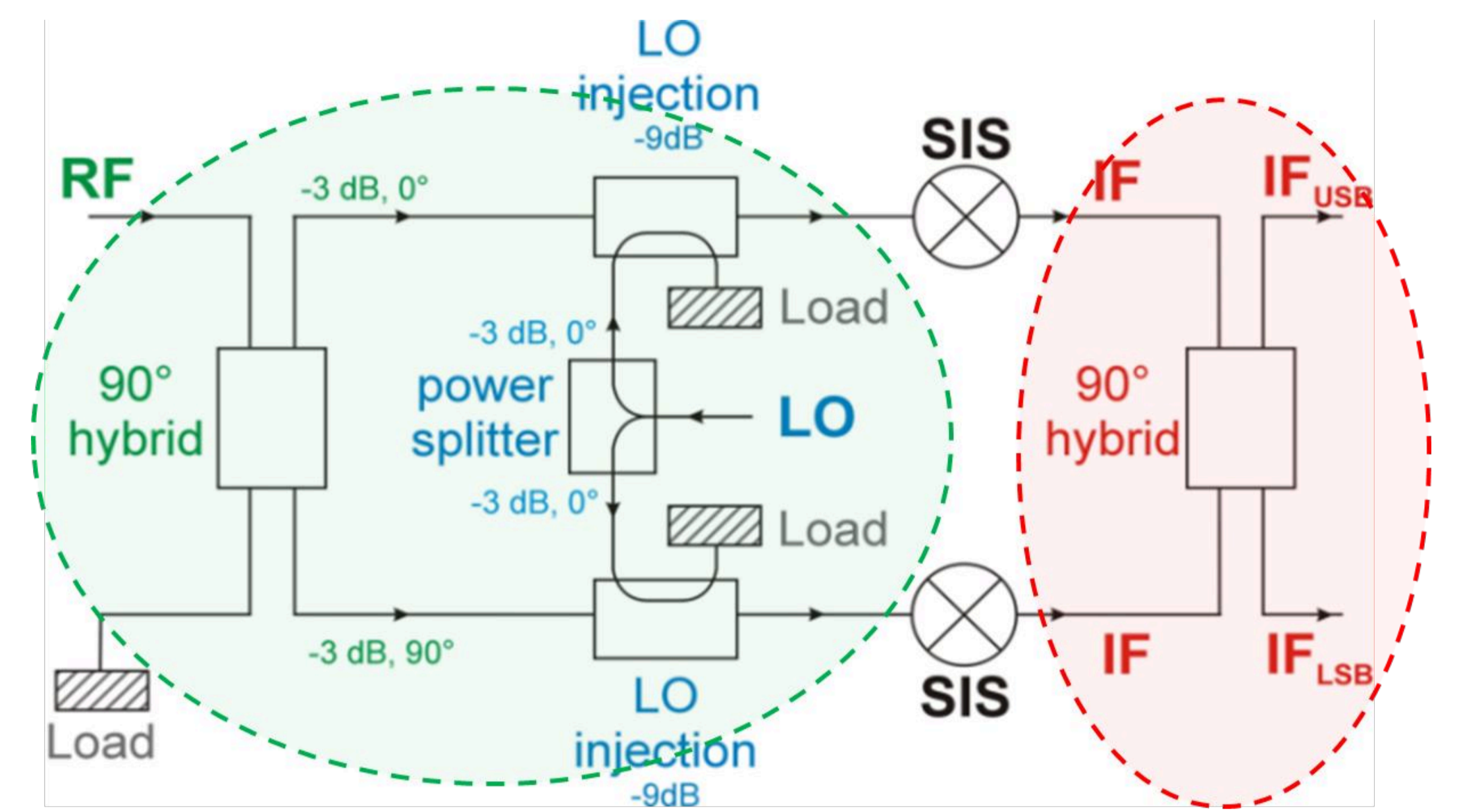
G. P. Nazarov ^{1,2,3}, A. V. Khudchenko ^{2,3}, I.V. Tretyakov ², K.I. Rudakov ^{2,3}, V.P. Koshelets ³

¹ Higher School of Economics (HSE)
² Astro Space Center of Lebedev Physical Institute of RAS
³ Kotelnikov Institute of Radio Engineering and Electronics of RAS

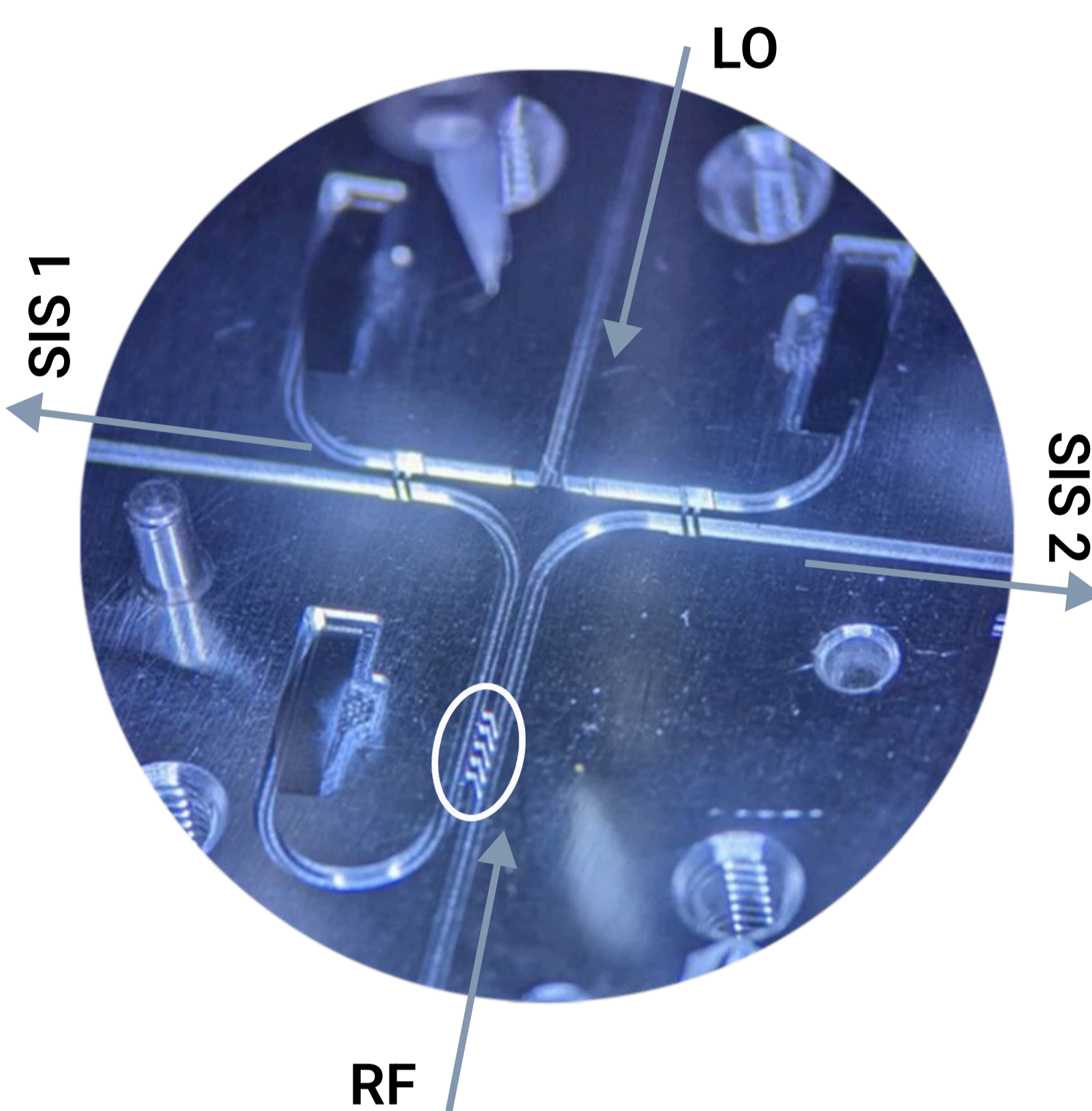
ABSTRACT:

The development of a waveguide block for a heterodyne receiver operating in the 210–270 GHz range with sideband separation is presented. This block includes: a four-port hybrid, two directional couplers, a T-shaped LO splitter, and waveguide loads. The Block equip with a pair of single-ended superconductor–insulator–superconductor (SIS) mixers represent the RF part of sideband separating mixer. We analyze the S-parameters of the entire waveguide structure and present an analytical model describing the quality of the sideband rejection ratio (SRR). The waveguide elements are designed with consideration for precision milling constraints, where the minimum feature size is determined by the cutter diameter, set at 150 μm in this case. The simulation results are validated through measured S-parameters of NiCr waveguide loads.

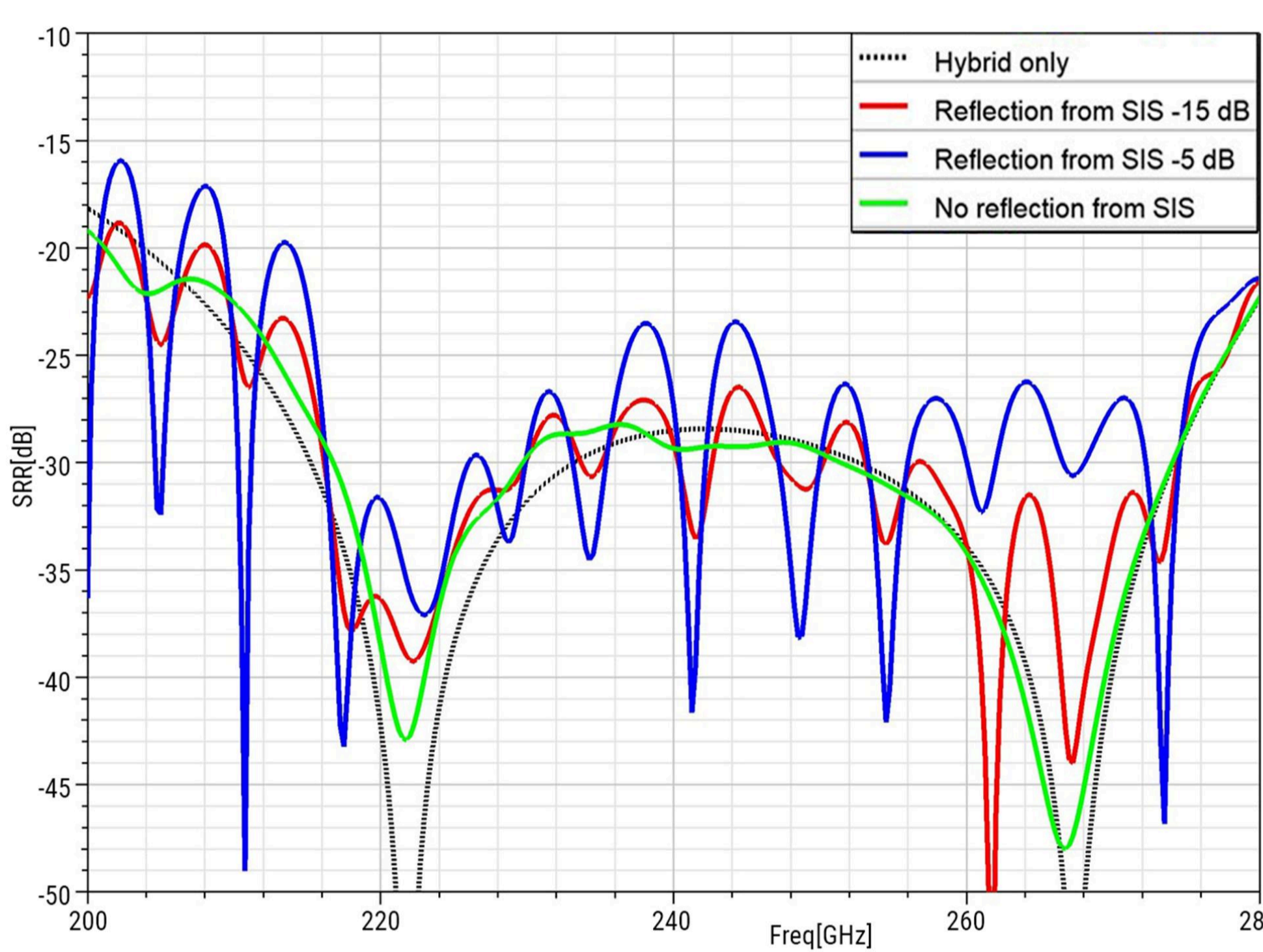
DIAGRAM OF THE 2SB MIXER:



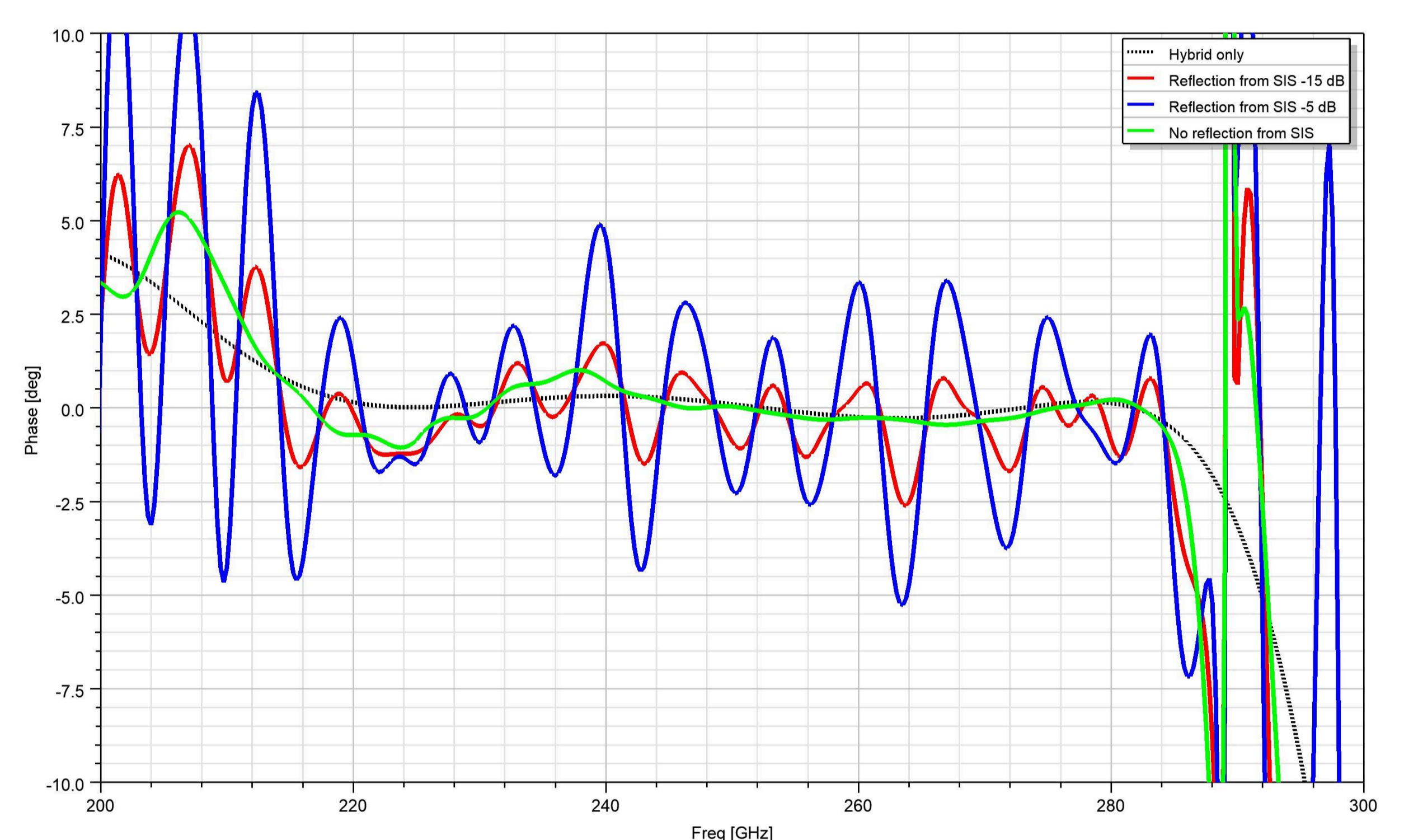
BLOCK DESIGN:



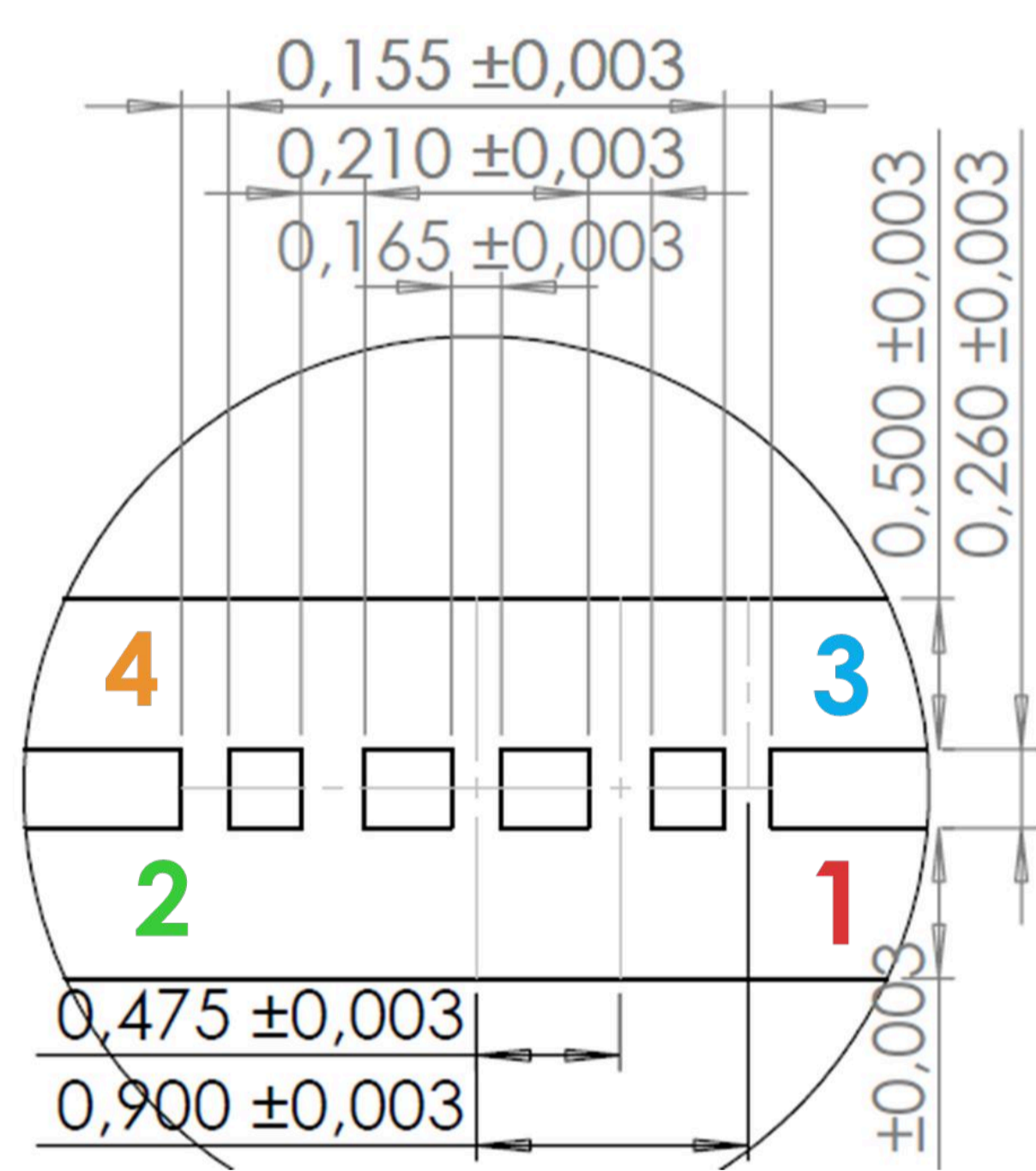
SIDEBAND REJECTION RATIO:



BALANCE PHASE:



HYBRID DESIGN:



HYBRID S-PARAMETER:

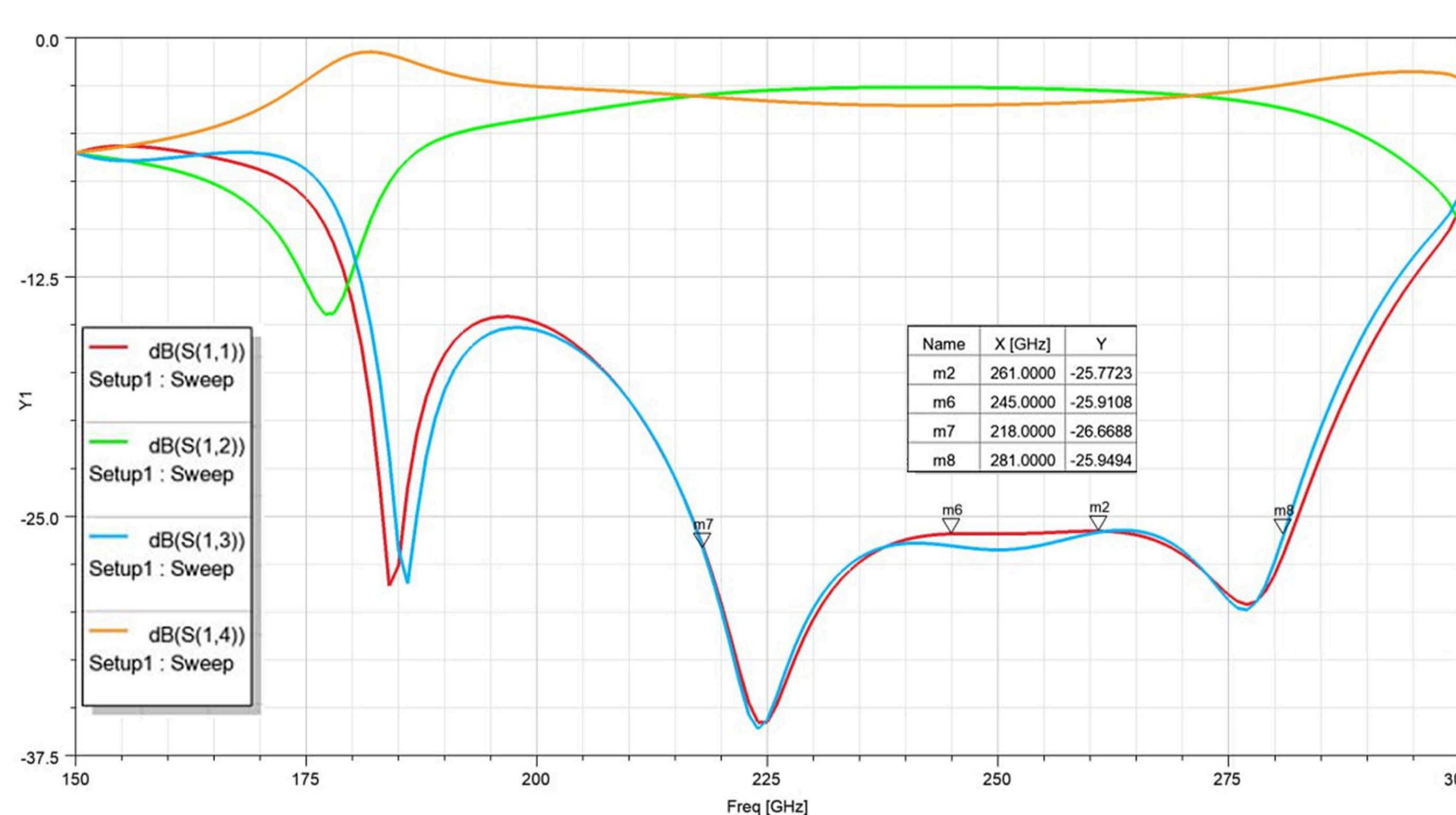
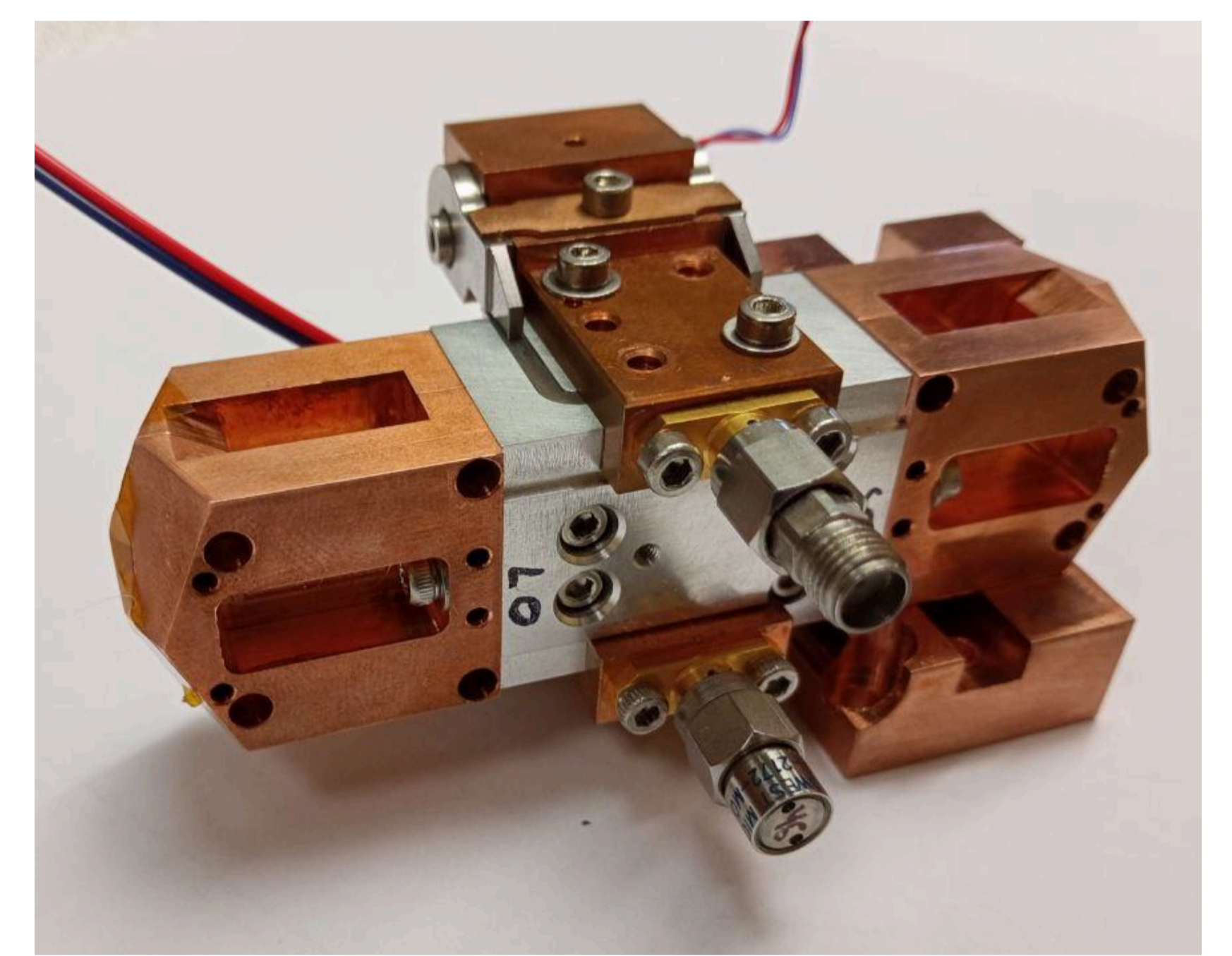
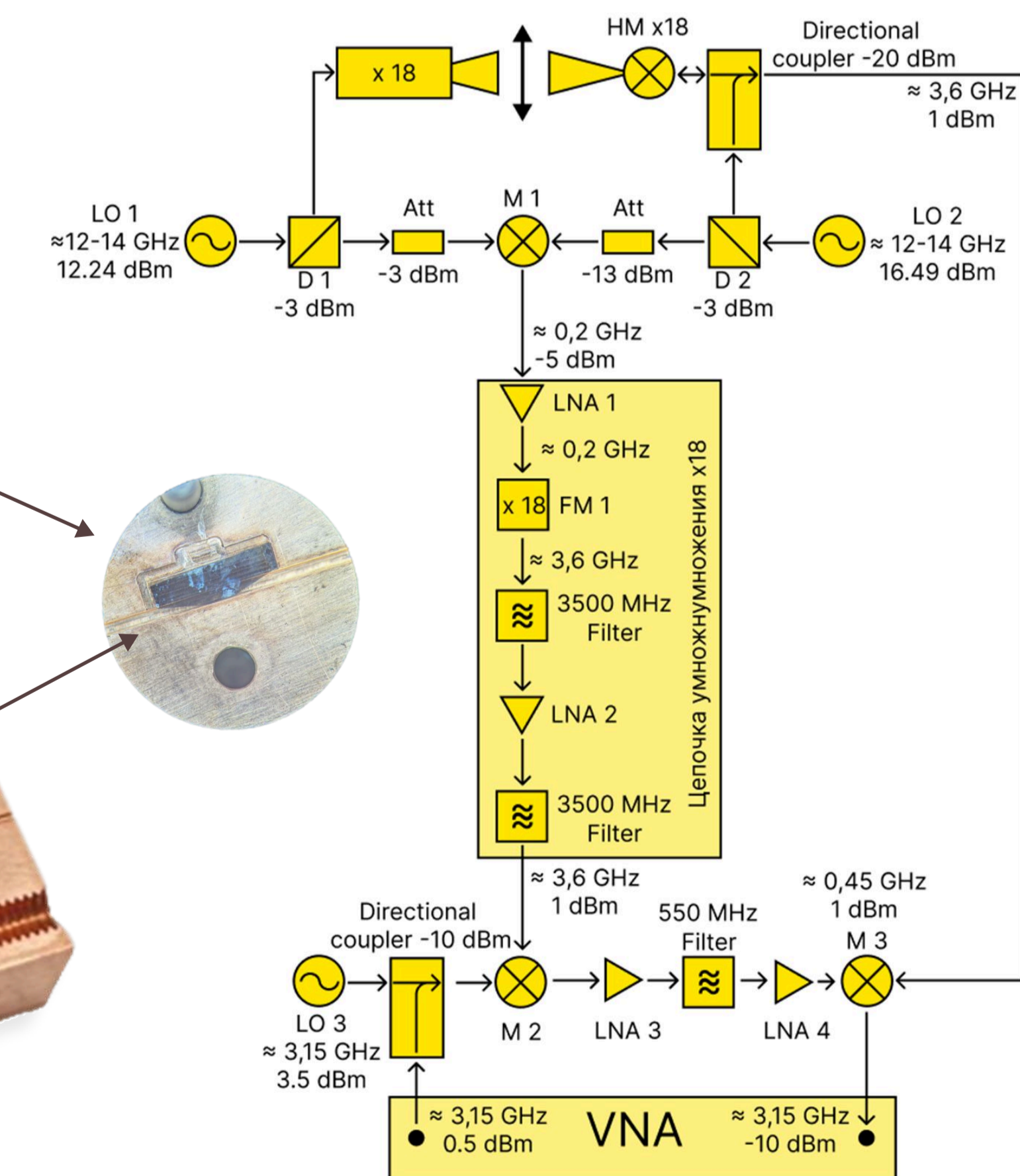
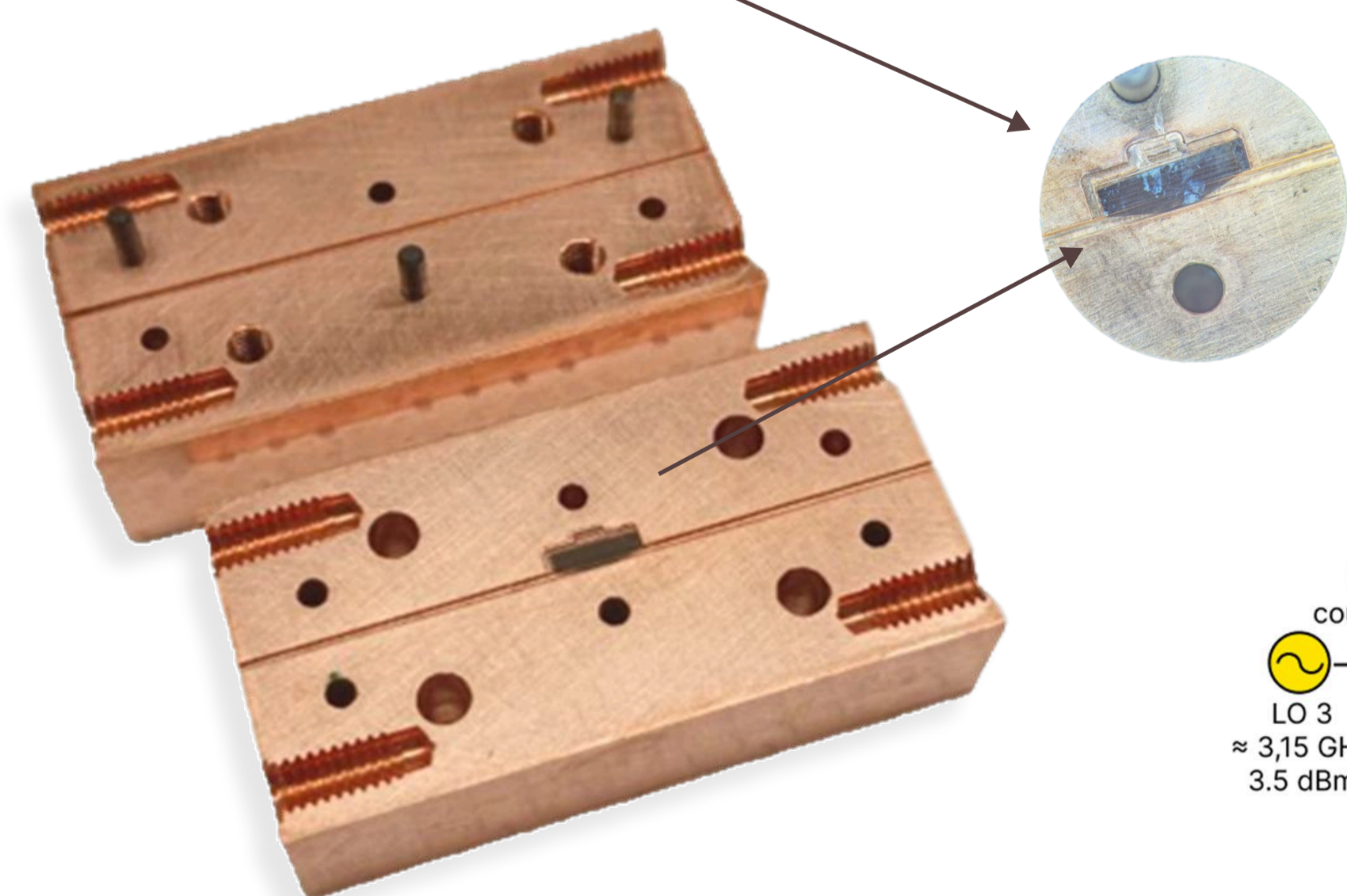


PHOTO:

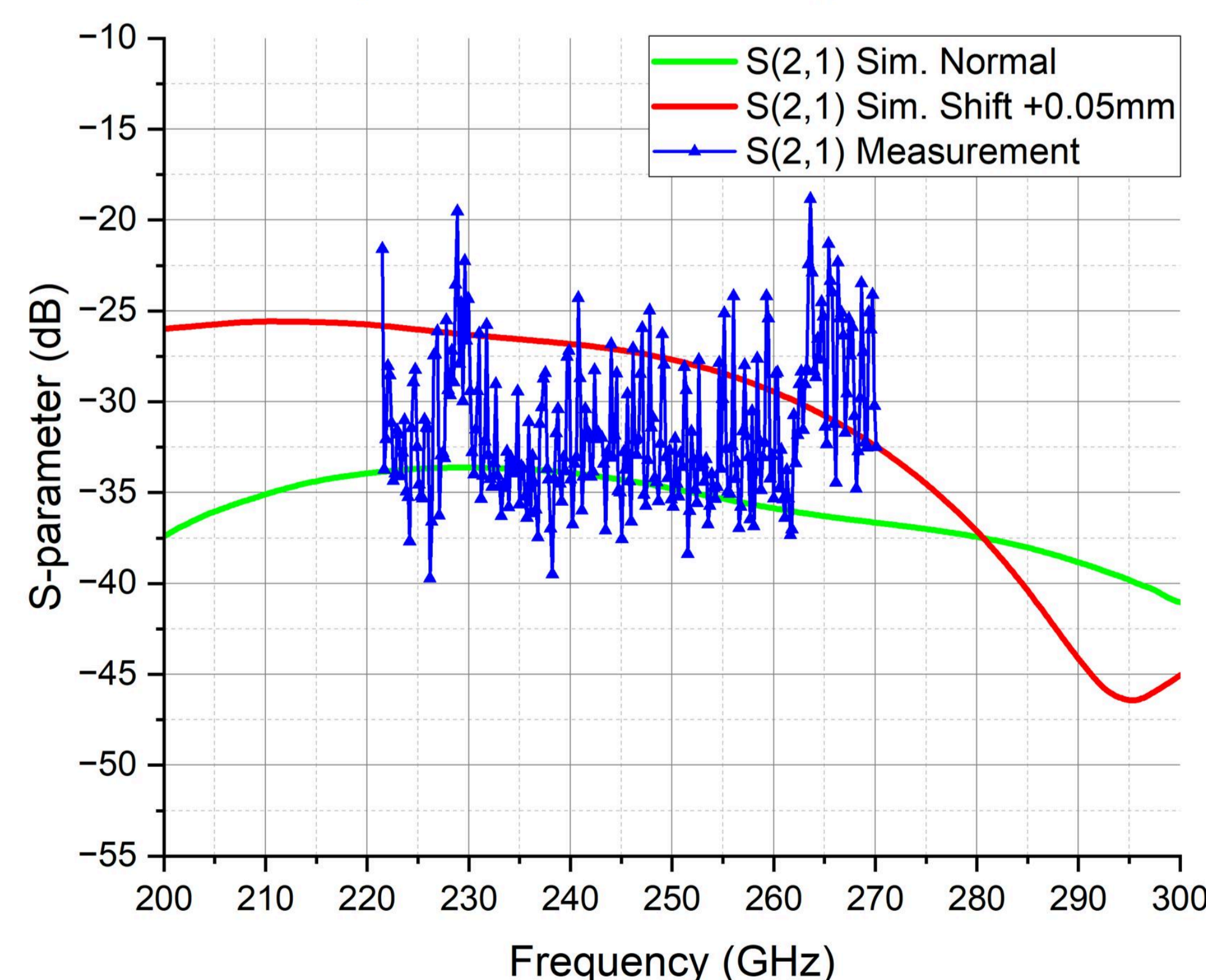


WAVEGUIDE LOAD:

Quartz glass 125 microns + NiCr 8 nanometres



S-parameters of the Waveguide Load



CONCLUSIONS:

- Simulation and experimental validation of nichrome waveguide load characteristics were made.
- A new waveguide block design for a 210-270 GHz frequency separating receiver has been designed.
- LO signal balance is also strongly influenced by reflections
- All described effects can be modeled and minimized for 300 GHz design.