Leaky Wave Antenna at 300 GHz in KTH's Micromachined Waveguide Technology

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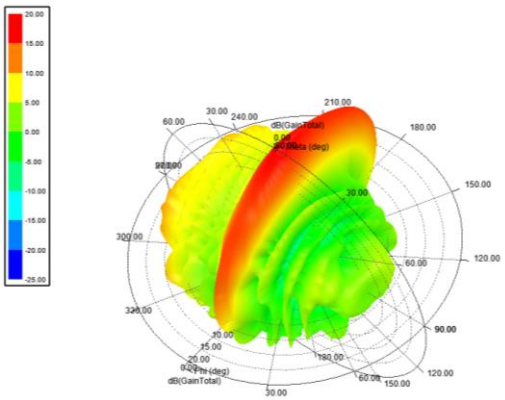
I. INTRODUCTION

The next generation wireless communications will use increasingly higher frequencies, as to ensure a large bandwidth and a high data speed. Different organizations propose to build 300 GHz wireless links for front haul and backhaul links. One key element is to obtain high gain antennas, as to extend the communication range and avoid interferences in a dense network [1]. The goal of the SSF project "MEMS THz systems" [2], is to enable the large-scale scientific and industrial exploitation of the THz range, by developing THz microsystems. In this context, KTH reported on the lowest loss silicon micromachined waveguide published to date [3]. In this paper, we report on the realisation of a high gain leaky wave antenna at 300 GHz.

II. DESIGN

An equally spaced leaky wave antenna (LWA) was designed and simulated in the Microwave group, at Uppsala University. The LWA has a broad side radiation pattern with a simulated gain of 15 dBi. This gain results from the 8 slots array composing the slotted waveguide antenna. The antenna dimensions for 300 GHz are 5.8 x 0.9 x 0.285 mm^3. The simulated radiation pattern with HFSS is shown below.

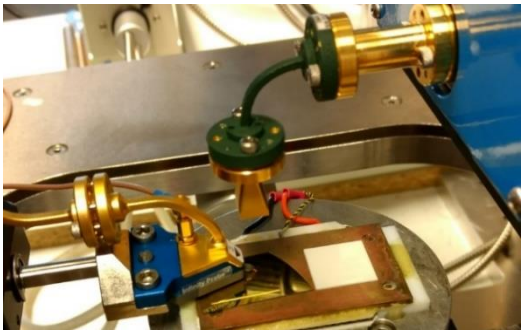


III. FABRICATION AND ASSEMBLY

The 300 GHz antenna was fabricated in a low-loss micromachined waveguide technology developed at KTH, consisting of a 285 µm thick silicon-wafer etched by deep-reactive ion etching, using a silicon dioxide mask. The wafers are metallized by gold sputtering of 1 µm and the assembly is realized using thermocompression bonding. More details on the fabrication process could be found in [2].

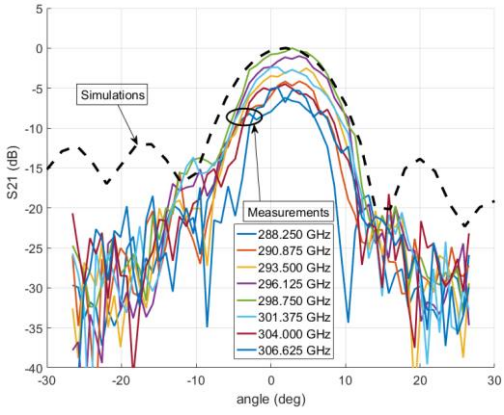
IV. MEASUREMENT SET-UP

The antenna under test (AUT) is connected with a coplanar probe of 75 µm pitch and the probe is connected with a waveguide to a T/R module operating at WR3 band. The receiver module T is connected to a 90 deg E bend and is further connected to a horn antenna with a gain of 20 dbi.



V. RESULTS

Antenna radiation patterns are shown for different frequencies ranging 288 - 306 GHz. The antenna shows the highest gain at 298.75 GHz where it is also having the best match (lowest S_{11}, not shown). Measurements were conducted at Uppsala University using a PNA N5225A Vector Network Analyzer with two WR-3 band TxRx millimetre-wave extenders from OML. The receiver is moved in the H plane, measurements are done every 0.5 mm and a corresponding angle theta is calculated.



VI. CONCLUSIONS

A 300 GHz silicon micromachined leaky wave antenna was designed, fabricated and measured. The measured results are in good agreement with the simulations.

VII. ACKNOWLEDGEMENT

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REFERENCES

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