Analytical modelling of THz frequency multipliers and mixers based on Schottky diodes

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***Abstract*— We present an analytical Schottky diode model implemented into commercial CAD simulator for accurate simulation of frequency multipliers and mixers. The model is verified against our numerical model and measurements. We have found good agreement between measured and simulated results. It is demonstrated that the model could become a prediction and circuit design tool of choice due to its efficiency.**

Future generation of MMIC-based multiplier and mixer circuits for THz frequencies demand for simulation tools, which include circuit design and accurate device simulation. Currently, such tools are not commercially available. With the rapid development of GaAs processes significant progress has been reported for multipliers. Similar results are expected from integrated mixer circuits. Planar Schottky diodes are important for Earth observation and atmospheric sensing missions.

This paper demonstrates as analytical physical Schottky diode model for frequency multipliers and mixers. This activity is part of ESA's effort towards Schottky diode technology with the according design tools. In previous work we have presented simulated results for frequency multipliers for the Herschel platform [1], [2].

The analytical physical Schottky diode model employed here has been published in previous publications [3], [4] with numerous modifications. The model is implemented into Agilent ADS2003C environment as a senior device model. It is supported by an equivalent numerical model described earlier [1]. The numerical model has been substantially improved and will be a subject of a different contribution.

Figure 1 shows the cascaded efficiency for a frequency multiplier chain. It can be seen that the overall efficiency can still be improved, as compared to measured results achieved today. Based on these results combined multiplier mixer circuits will be demonstrated at the conference.

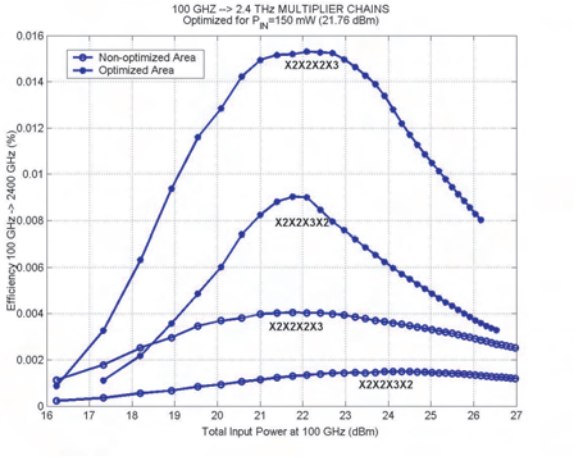

Fig. 1. Simulated and measured cascaded effi ciency versus the power level at 100 GHz.

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