A 900GHz Broadband Balanced Frequency Quadrupler

F. Yang[1]

Terahertz sources have attracted recent interest for both high resolution radar imaging and radio astronomy applications. For such applications, it is important to have compact sources that produce enough power to pump the front end of the transceiver.

For terahertz multiplier sources, cascading multipliers is a pragmatic approach. It typically consists of a chain of doublers and triplers[1][2] which are selected to yield the desired output frequency. The final efficiency of a multi-stage chain, as a result, is often on the order of a few percent or less [3]. Moreover, inter-stage mismatches in the chain can readily influence adjacent stages by pulling them from their optimum operating status and reducing efficiencies. Direct multiplication to a high-order harmonic greater than the third is desirable for higher frequency band, even with the challenges including proper termination of all intermediate harmonics (idlers).

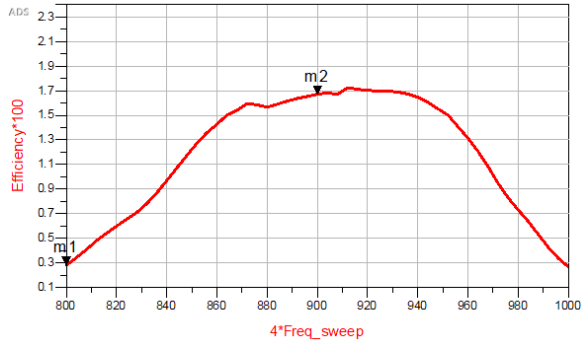

Fig.1. Power efficiency simulation of the 900 GHz GaAs membrane frequency Quadrupler

The work presented here applies the GaAs membrane substrate technology to implement an integrated frequency quadrupler. This Quadruplers features 2 anodes in series balanced configuration and is connected to a split waveguide-block by metallic beam-leads. The simulation results gives about 0.8%-1.7% multipling efficiency from 830 GHz to 980 GHz and 0.4 mW of maximum output power with 24 mW of input power at 225 GHz.

[1] State Key Lab of Millimeter Waves, Southeast University, Nanjing, 210096 , Jiangsu, China.
Email: yangfei@seu.edu.cn

REFERENCES

[1] Maestrini A, Gatilova L, Treuttel J, et al. 1200GHz and 600GHz Schottky receivers for JUICE-SWI[C], International Symposium on Space Terahertz Technology. 2016.

[2] J. Treuttel; L. Gatilova ; F. Yang ; et al., A 330 GHz frequency doubler using European MMIC Schottky process based on e-beam lithography, 2014 XXXIth URSI General Assembly and Scientific Symposium (URSI GASS), Beijing, 2014, pp. 1-4.

[3] Mehdi I, Siles J V, Lee C, et al. THz Diode Technology: Status, Prospects, and Applications[J]. Proceedings of the IEEE, 2017, 105(6):990-1007.

NOTES: