



A Wideband G-Band Low-Noise Amplifier Design

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Introduction

The G-band (140–220 GHz) has emerged as one of the promising frequency bands for next-generation applications, thanks to its vast available bandwidth. To realize a high-sensitivity receiver for these systems, it is essential to develop a Low Noise Amplifier (LNA) with both high gain and a low noise figure (NF). However, designing an LNA in the G-band faces significant challenges, such as the limited power gain of transistors. In this work, a multi-stage G-band LNA with wide bandwidth utilizing G_{\max} -core technique is designed and implemented using 28-nm FDSOI technology.



1. Circuit Design

- Each amplifier stage employs a common-source (CS) topology integrated with the G_{\max} -core technique [1].
- To achieve a wider bandwidth, a staggered-tuning scheme is implemented in each interstage matching network.

2. Simulation Result

- $\text{Gain}_{\text{peak}} = 10.2 \text{ dB @ } 200 \text{ GHz}$
- $3\text{-dB BW}(S_{21}) = 173 - 215 \text{ GHz (42 GHz)}$
- $\text{IP}_{1\text{dB}} = -20 \text{ dBm}$
- $P_{\text{sat}} = -5.25 \text{ dBm}$
- $\text{NF} = 11.8 \text{ dB}$
- $3\text{-dB BW}(\text{NF}) = 148.5 - 223.5 \text{ GHz (75 GHz)}$

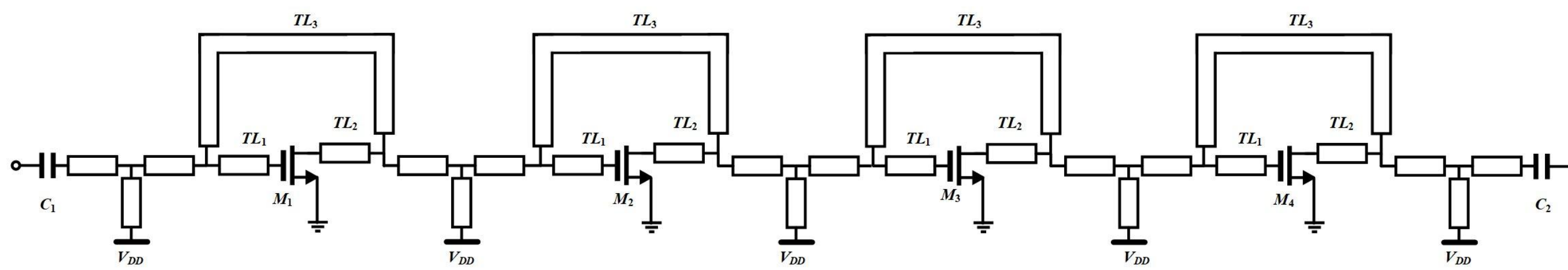


Fig. 1. Schematics of the AMC.

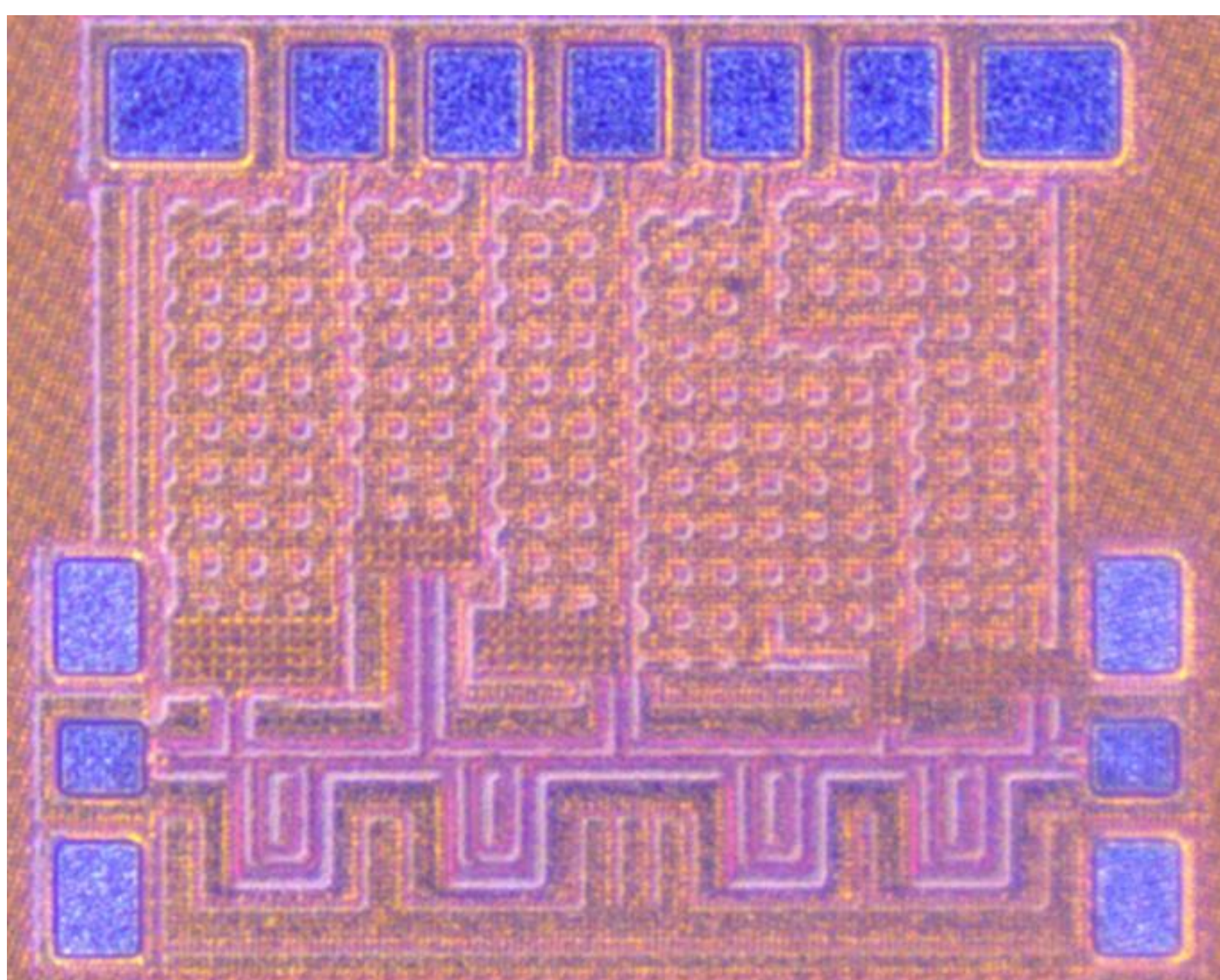


Fig. 2. Chip photo of the AMC.

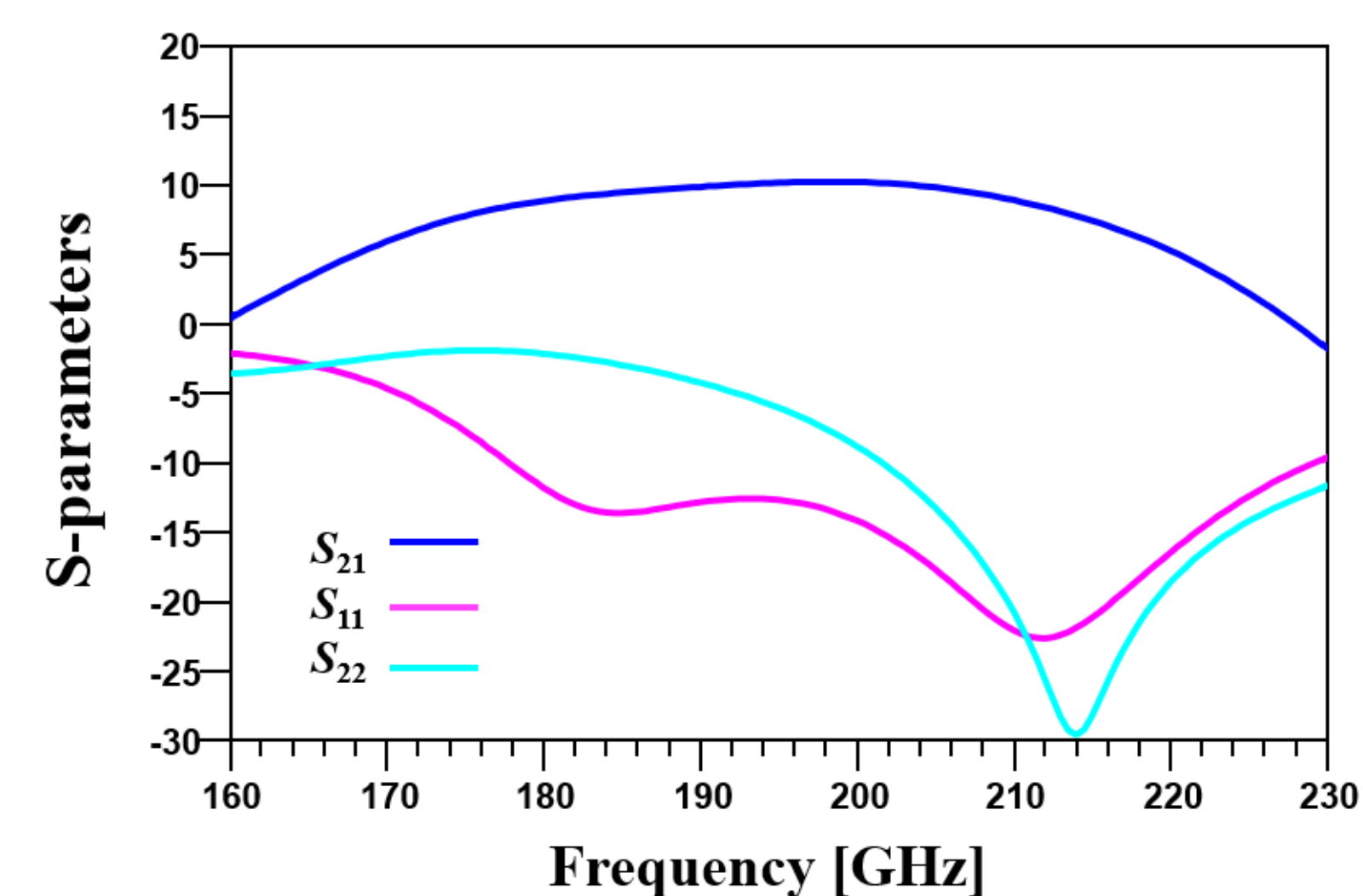


Fig. 3. S-parameter simulation.

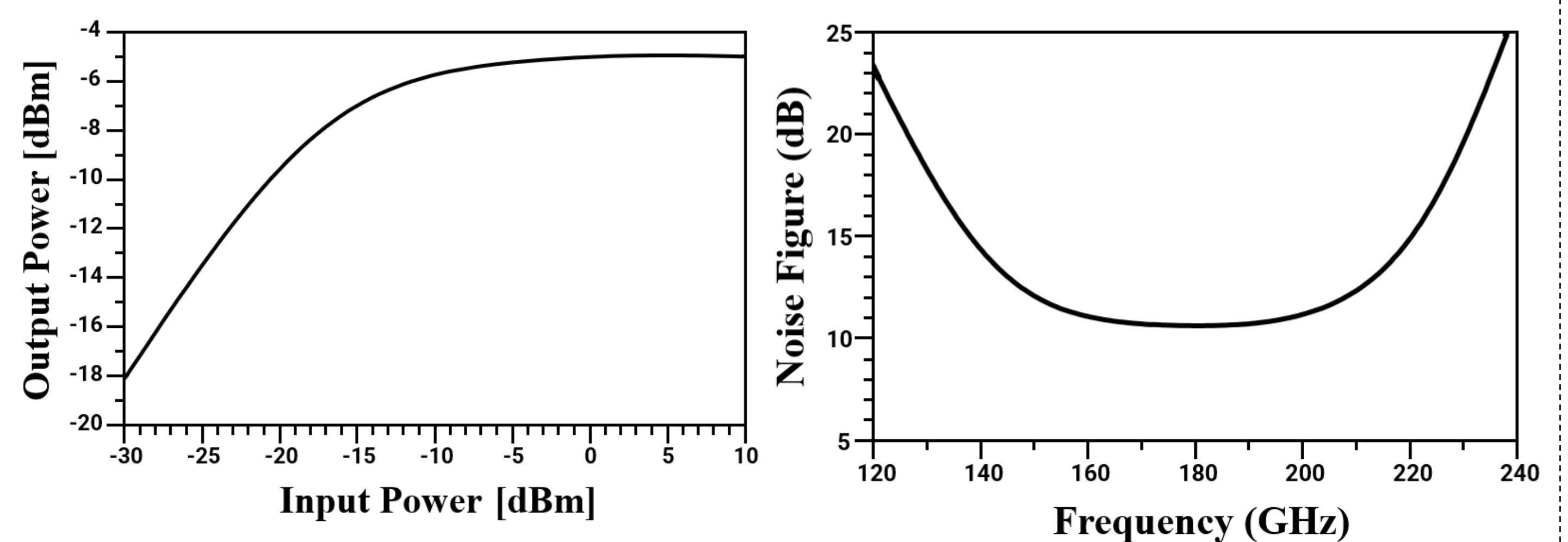


Fig. 4. (a) P_{out} vs. P_{in} and (b) noise figure simulation.

Conclusion

In this work, a G-band LNA is designed using Samsung 28-nm FDSOI technology. The proposed LNA achieves a peak gain of 10.2 dB with a 3-dB bandwidth of 42 GHz. To maximize gain, each stage employs a common-source topology with the G_{\max} -core technique. Furthermore, a staggered-tuning scheme is implemented in the interstage matching networks to achieve broadband performance across the G-band. With its high gain and wide bandwidth, this amplifier is well-suited for sub-THz systems, including 6G wireless communications, high-resolution radar, and imaging applications.

Acknowledgement

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Reference

[1] D.-W. Park, B. Yun, D. R. Utomo, J.-P. Hong, and S.-G. Lee, "A 201- and 283-GHz Dual-Band Amplifier in 65-nm CMOS Adopting Dual-Frequency G_{\max} -Core With Dual-Band Matching," IEEE Transactions on Terahertz Science and Technology, vol. 13, no. 3, pp. 221-230, 2023, doi: 10.1109/tthz.2023.3263644.