A Reconfigurable S/X-Band CMOS Power Amplifier for High Resolution Radar Transceivers

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Ⅰ. Introduction

Modern radar systems often require multi-band operations due to the different characteristics of the environment and targets. Most of the updated dual-band CMOS PAs are not large enough for the frequency difference and several single-band PAs directly assembled into a single chip have been presented [1]. This paper suggests a two-stage reconfigurable S/X-band PA integrated into a 0.18-μm CMOS process for high resolution radar transceivers.

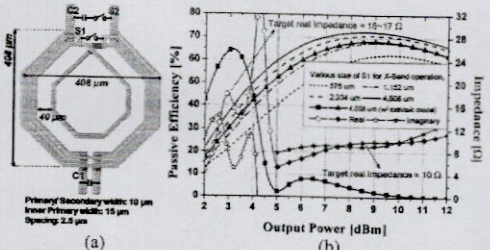
Ⅱ. Design and Measurement Results

The designed PA consists of a differential driver/main stage with an input/output matching network (OMN) and it operates in the S/X-band.

An integrated switchable transformer for the OMN, as illustrated in Fig. 1, provides optimum load impedances and high efficiencies in the S/X-band. A primary inductance increases for the S-band due to the inner turn winding and a shunt capacitance at 50 ohm load decreases X-band due to the OFF-capacitance of S2. S1/S2 is turned OFF/ON for the S-band, while S1/S2 is turned ON/OFF for the X-band.

The practical unbalance layout of the OMN severely occurs the asymmetric differential-load, especially for the X-band operation. To alleviate the effects, series L-C circuits resonating 8.5 GHz are required to forcibly ac-ground common-mode nodes.

A PA with tunable elements only in the OMN generates a maximum power gain of 24.0/19.4 (16.3) dB and a P_{SAT} of 24.8/21.5 (21.5) dBm with a PAE of 32.8%/11.1% (10.7%) at 3.0/8.0 (9.0) GHz, respectively. With a BW_{1-dB} of 2.8-3.4/7.5-9.5 GHz, this proposed PA is likely suitable for use in a dual-band high resolution systems.



(a) (b)

Fig. 1. (a) Physical layout of the output matching network, (b) Passive efficiencies with various sizes of S1 and complex impedances for the S/X-band operation.

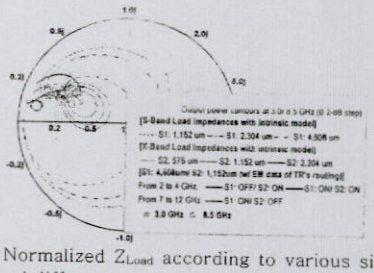


Fig. 2. Normalized Z_{Load} according to various sizes of S1/S2 and different switch operations.

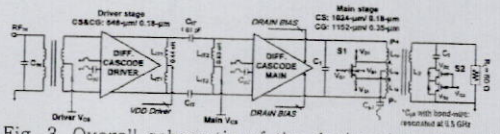
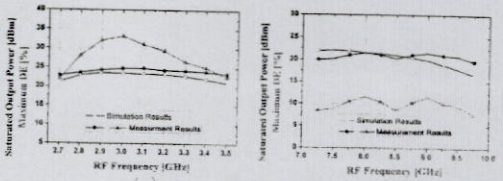


Fig. 3. Overall schematic of the designed dual-band CMOS PA.



(a) (b)

Fig. 4. Measured P_{SAT} and DE versus frequencies in (a) the S-band and (b) the X-band.

Acknowledgement

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References

[1] W.-Y. Kim, H. S. Son, J. H. Kim, J. Y. Jang, I. Y. Oh, and C. S. Park, "A fully integrated triple-band CMOS class-E power amplifier with a power cell resizing technique and a multi-tap transformer," IEEE Microw. Wireless Compon. Lett., vol. 23, no. 12, pp. 659-661, Dec. 2013.