A Fully Integrated Dual-Band CMOS Power Amplifier for S/X Band Radar Applications

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I. Introduction

In radar system, the appropriate frequency band differs according to the environment. Therefore, it is desired to develop design approaches for dual band radar system which can use appropriate frequency band in different situations. However, most of the updated dual band power amplifiers (PAs) are not large enough for the frequency difference between two bands and they are designed with external matching networks [1]. This paper suggests the fully integrated dual-band CMOS power amplifier with a reconfigurable transformer.

II. Design and Simulation Results

This paper applies a switched transformer for a dual-band matching network, using the 0.18-μm RF CMOS process. By using the designed transformer, as illustrated in Fig. 1, the load impedances can be located at the output power contours based on load-pull simulations at each band. The primary winding has an inner turn inductor to increase the inductance for the lower-band output matching, and a switch is connected in parallel to the inner turn inductor. To realize the tunable capacitor at secondary winding, a two-stacked transistor is used to have the power handling capability. In Fig. 2, differential cascade amplifiers are applied at driver and main stages, and fundamental resonance circuits at the common nodes of common sources are used to achieve higher output performance.

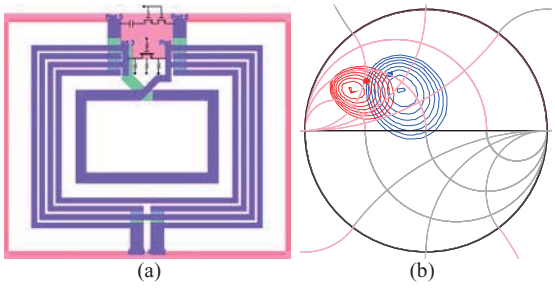

Fig. 1. (a) Schematics of the proposed switched transformer. (b) Output power contours based on load-pull simulations at 3.5 GHz (Blue) and 9.0 GHz (Red) and the load impedances of the designed transformer.

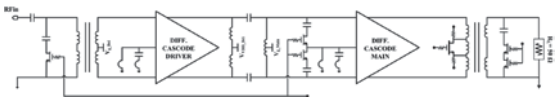

Fig. 2. Overall schematic of the proposed dual-band CMOS power amplifier.

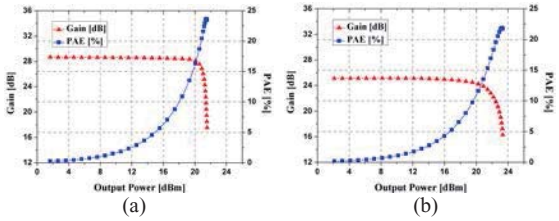

Fig. 3. Simulated gain and PAE as a function of Pout with a CW input at 3.5 GHz(a) and 9.0 GHz(b).

As illustrated in Fig. 3, the proposed PA has a P1dB of 20.5 dBm and a maximum PAE of more than 21 % for both 3.5 GHz and 9.0 GHz using a 1.8 V and 3.6 V supply.

Since the PA shows the dual-band characteristic with the compatible performance at X-Band [2], this design approach can be useful for dual-band radar applications.

Acknowledgement

This work was supported by the IDEC.

References

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