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# Wideband Doherty Power Amplifier Design for Base Station Application

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By

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# Abstract

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Doherty Power Amplifier (DPA) is employed to improve the efficiency when operated with complex modulated signals. Due to its simplicity and high efficiency performance, it has become the preferred choice of industry. However, practical implementations of DPA only provide limited RF bandwidth, especially at high power level. The traditional narrow band device matching network, required phase shift for proper load modulation and impedance inverter seriously limit the bandwidth of DPA.

In this work, the frequency behavior of the ideal 2-way symmetrical DPA is analyzed in detail, followed by the introduction of two new impedance inverters used to improve the bandwidth of DPA. In order to fully exploit the wideband potential of the new impedance inverters, the phase relation between the main and peak amplifier should be adjusted according to the power level at every frequency, which can be stored in a lookup table. Based on a previous wideband 20W DPA with mixed-signal input drive, in which the device output capacitance is incorporated into the impedance inverter, a modified DPA using the idea of compensated impedance inverter is designed and simulated. The prototype DPA design is implemented with NXP LDMOS bare die device. Simulation results have shown more than 50% 6dB back off efficiency from 1.5GHz to 2.2GHz, compared with the original case whose 50% efficiency bandwidth is from 1.9GHz to 2.3GHz.

Since the prototype DPA is implemented at a low power level with bare die devices and mixed-signal input drive, it cannot be used for the practical base station applications. Traditional high power discrete DPA design method is introduced and the frequency behavior is analyzed. It is found that for the high power DPA, the matching network and the offset line are more important than the impedance inverter for the narrow bandwidth of DPA. A new DPA structure was proposed for wideband operation. Simulation results show smaller gain and power added efficiency spread in a 200MHz frequency band from 2.04GHz to 2.24GHz than the traditional DPA.



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