Time Mismatch Effects in a Dynamic Load Modulation Transmitter Architecture

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***Abstract*—In this paper, the effect of time mismatch between the RF input and baseband control signals in a dynamic load modulation transmitter is investigated. Experimental results show that even a small time mismatch between the input signals can result in severe distortion of the output signal.**

I. Introduction

High efficiency transmitter architectures are very crucial for modern wireless communication systems, especially when high peak-to-average ratio signals are used. In literature, several architectures have been proposed. Among them, dynamic power supply schemes, envelope tracking (ET) and dynamic load modulation (DLM) techniques have shown promising results.

In both ET and DLM architectures, synchronization of the envelope control signal and the RF input signal is very important. It has been shown than even a small time mismatch can produce a lot of distortion in ET transmitters. In this paper, we investigate the effect of the time mismatch in the DLM transmitter architecture.

II. Experimental Results

In this section, experimental results are used to show the effect of time alignment between the envelope control signal and RF input signal. The measurement setup is shown in Fig. 1.

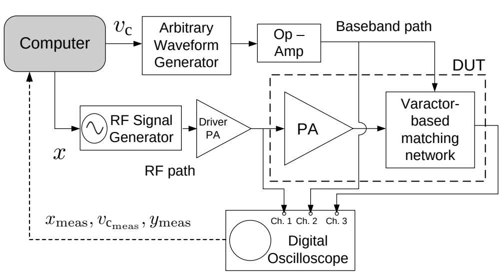

Fig. 1: Measurement setup for dynamic load modulation transmitter architecture.

The RF input signal is a one-carrier WCDMA signal, and the device under test (DUT) is a high efficiency 10 W class J power amplifier and the varactor matching network.

Since different delay exists in the baseband path and the RF path, in order to minimize the distortion due to the time mismatch, accurate relative delay is needed to align the complex baseband input signal x and the baseband control signal v_c. These signals are constructed by the quasi-static inverse model.

The time mismatch effects on in-band distortion is shown in Fig. 2. It can be noticed that, even one baseband sample delay, the normalized mean square error (NMSE) difference is more than 3 dB. Further, this figure also shows that the power added efficiency (PAE) is affected by the time alignment.

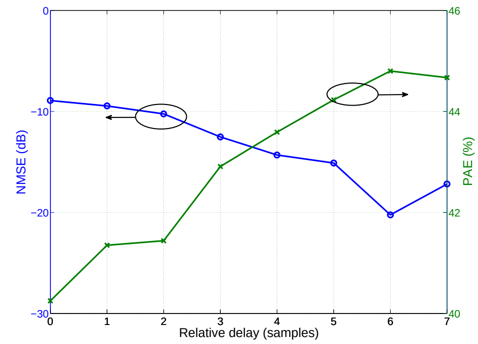

Fig. 2: Normalized mean square error and power added efficiency for different relative delays. Sampling frequency = 30.72 MHz.

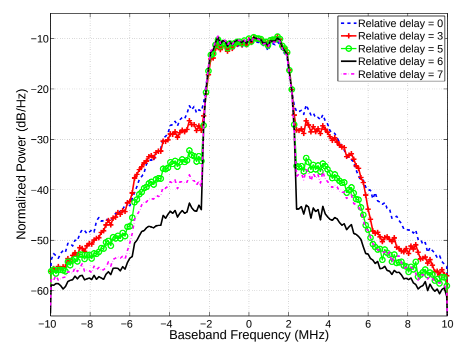

Fig. 3: Output signal power spectrum for different relative delays

Fig. 3 shows the out-of-band distortion with different relative delays. We can see that the dynamic range is greatly improved if accurate time alignment is performed.

III. Conclusion

This paper investigated the distortion in the DLM architecture due to the time mismatch effect. The experimental results has shown that, with accurate time alignment, both the in-band and out-of-band distortion can be suppressed and the PAE is also improved.

Acknowledgment

This research has been carried out in the GigaHertz centre in a joint research project financed by the Swedish Governmental Agency of Innovation Systems (VINNOVA), Chalmers University of Technology, Ericsson AB, Infineon Technologies, and NXP Semiconductors.