Abstract

An envelope tracking DC-DC converter is usually considered to improve efficiency of a radio-frequency power amplifier (RFPA), particularly in battery powered portable devices. However, it remains a challenge to select a suitable DC-DC converter topology which needs to track the envelope of the modulated signal with high bandwidth and also to retain a considerably high efficiency of the switching converter. This report considers a single-inductor-multiple-output(SIMO) DC-DC buck converter and designs suitable power circuit parameters to achieve high bandwidth along with improved efficiency. Existing topologies, such as synchronous, multi-phase and multi-input buck converter topologies, along with the SIMO buck converter topology are simulated using PSpice circuit simulator. Power loss and time optimal performance are formulated. A study comparing performance and efficiency is tabulated using a test case, which shows that a SIMO-based architecture can outperform existing architectures. A hardware prototype of 4-output SIMO DC-DC buck converter is designed and fabricated using a printed circuit board (PCB). The hardware prototype is tested for tracking various reference envelopes of frequency upto 40 kHz. The converter is able to track waveforms having sharp peaks without losing peak information. This indicates a high bandwidth of the proposed topology for fast changing envelope signals. The future work will consider experimental validation of the tracking performance of SIMO buck converter (i) using communication signal envelopes such as 2G, EDGE, LTE etc. as references, and (ii) using real RFPA load.