Multi Carrier Modulation Audio Power Amplifier with Programmable Logic

While switch-mode audio power amplifiers allow compact implementations and high output power levels due to their high power efficiency, they are very well known for creating electromagnetic interference (EMI) with other electronic equipment. To lower the EMI of switch-mode (class D) audio power amplifiers while keeping the performance measures to excellent levels is therefore of high interest. In this paper a class D audio amplifier utilising Multi Carrier Modulation (MCM) will be analysed, and a prototype Master-Slave Multi Carrier Modulated (MS MCM) amplifier has been constructed and measured for performance and out of band spectral amplitudes. The basic principle in MCM is to use programmable logic to combine two or more Pulse Width Modulated (PWM) audio signals at different switching frequencies. In this way the out of band spectrum will be lowered compared with conventional class D amplifiers. Analytically expressions, simulations and measurements result in reduced switching frequency amplitudes using MCM techniques. It is also shown that the Total Harmonic Distortion (THD) tends to be compromised compared to conventional class D amplifiers due to intermodulation products of the switching frequencies entering the audio band. Still, the MS MCM topology with two carrier signals shows a 6 dB reduction of the switching frequency amplitudes as well as THD across the audio band below 1% at 55 W output power open loop.