POWER AMPLIFIER MODULES WITH CONTROLLABLE ENVELOPE TRACKING NOISE FILTERS

BACKGROUND

Field

[0001] Embodiments of the invention relate to electronic systems, and in particular, to power amplifiers for radio frequency (RF) electronics.

Description of the Related Technology

[0002] Power amplifiers are used in RF communication systems to amplify RF signals for transmission via antennas. It is important to manage the power of RF signal transmissions to prolong battery life and/or to provide a suitable transmit power level.

[0003] Examples of RF communication systems with one or more power amplifiers include, but are not limited to, mobile phones, tablets, base stations, network access points, customer-premises equipment (CPE), laptops, and wearable electronics. For example, in wireless devices that communicate using a cellular standard, a wireless local area network (WLAN) standard, and/or any other suitable communication standard, a power amplifier can be used for RF signal amplification. An RF signal can have a frequency in the range of about 30 kHz to 300 GHz, such as in the range of about 410 MHz to about 7.125 GHz for fifth generation (5G) communications using Frequency Range 1 (FR1) or in the range of about 24.25 GHz to 52.6 GHz for 5G communications using Frequency Range 2 (FR2).

SUMMARY

[0004] In certain embodiments, the present disclosure relates to an envelope tracking system. The envelope tracking system includes an envelope tracker configured to generate a power amplifier supply voltage that changes is relation to an envelope of a radio frequency signal, and a power amplifier module including a power amplifier configured to amplify the radio frequency signal and to receive power from the power amplifier supply voltage, the power amplifier module further including a controllable filter configured to filter the power amplifier supply voltage to provide envelope tracking noise filtering. In an aspect, there is provided a mobile device, comprising a transceiver configured to generate a radio frequency signal; a power management system including an envelope tracker configured to generate a power amplifier supply voltage that changes is relation to an envelope of the radio frequency signal; and a power amplifier module including a power amplifier configured to amplify the radio frequency signal and to receive power from the power amplifier supply voltage, the power amplifier module further including a controllable filter configured to filter the power amplifier supply voltage. In an aspect, there is provided an envelope tracking system comprising an envelope tracker configured to generate a power amplifier supply voltage that changes is relation to an envelope of a radio frequency signal; and a power amplifier module including a power amplifier configured to amplify the radio frequency signal and to receive power from the power amplifier supply voltage, the power amplifier module further including a controllable filter configured to filter the power amplifier supply voltage to provide envelope tracking noise filtering. In an aspect, there is provided a method of envelope tracking in a mobile device, the method comprising: generating a power amplifier supply voltage that changes is relation to an envelope of a radio frequency signal using an envelope tracker; amplifying the radio frequency signal using a power amplifier of a power amplifier module; powering the power amplifier using the power amplifier supply voltage; and filtering the power amplifier supply voltage using a controllable filter of the power amplifier module.