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Dynamic Power Index Adjustment Based On Battery Level

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ABSTRACT

This disclosure describes techniques for dynamic adjustment of output power index of a wireless remote controller device based on a detected battery level of the device. The battery voltage level of the device is periodically measured. When the level falls below a predetermined threshold, the output power index is adjusted to ensure that the total transmit power from the controller device lies within a specified range. Dynamic adjustment of transmit power via the power index adjustment enables the controller device to have a transmit power that lies between the power spectral distribution (PSD) target and the PSD limit (maximum) over a range of battery voltage values.

KEYWORDS

- Transmit power
- Remote controller
- Linear mode
- Power index
- Radio frequency (RF) transceiver
- Power spectral distribution (PSD)

BACKGROUND

Wireless control devices such as remote controllers for televisions, garage door openers. etc., upon receipt of user input, transmit a signal to a receiver located on a corresponding main device. For example, a controller device can be utilized to transmit a signal indicative of change of a channel on a television or a signal indicative of a command to open or close a garage door. The range of a controller device is linked to its output transmit power which needs to meet a

certain minimum threshold as well as be under a maximum threshold that is based on government regulations, such as “conformity with European” (CE), federal communications commission (FCC) regulations, or other applicable regulations that place limits on wireless transmission energy.

In some controller devices, the transmit power is sensitive to supplied battery voltage, particularly at higher frequencies. For example, a controller device can have adequate range with a newly installed battery, but can have a diminished range (maximum distance from a main device that the controller device is used to control) subsequently as the battery drains and its voltage drops below a threshold. The reduced controller range causes a deterioration in the user experience.

DESCRIPTION

This disclosure describes techniques for dynamic adjustment of an output power index based on the detected battery level in a wireless controller device. An output power index setting is commonly utilized, for example, in a radio frequency (RF) front-end of a controller device, to configure output transmit power in predetermined step sizes, e.g. 1dB.

Per techniques of this disclosure, the available battery level of the wireless control device is periodically measured. When the battery level meets a predetermined threshold, the output power index is adjusted to ensure that the total transmit power from the controller device lies within a specified range.

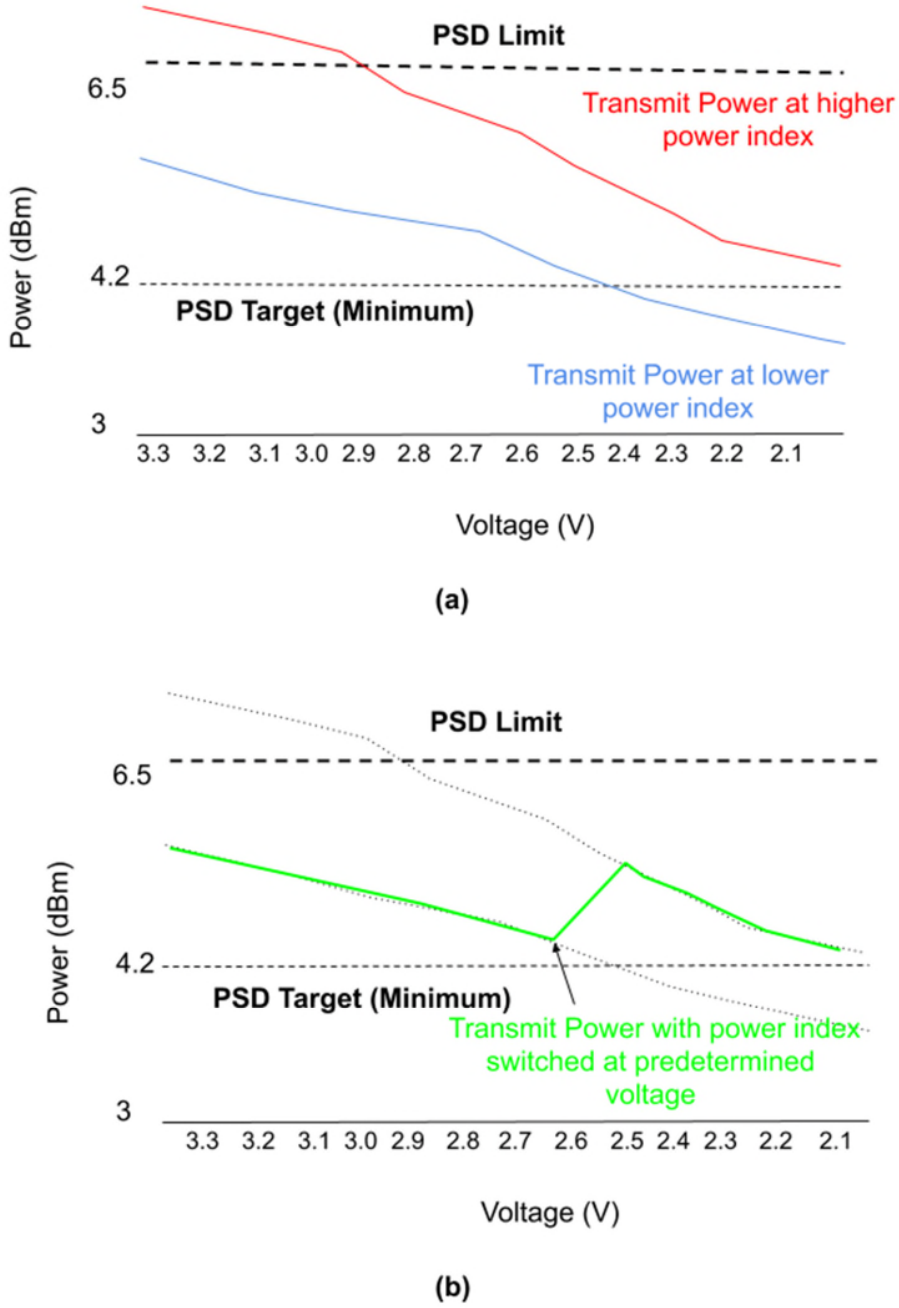

Fig. 1: Transmit power with; (a) fixed power index and; (b) dynamic power index

Fig. 1 depicts transmit power from a controller device as a function of battery voltage. A power spectral density (PSD) limit line indicates a maximum permitted transmit power and a

PSD target line indicates a minimum PSD transmit power that ensures that the design range for the controller device is met.

As depicted in Fig. 1(a), at a higher power index setting (indicated by the red line), the transmit power meets the PSD target at all battery voltage values. However, when the battery voltage is relatively high (in this example, above about 2.8V), the transmit power exceeds the PSD limit. In this illustrative example, the higher power index setting may be set at a value about 1dB greater than the lower power index setting. At a lower power index setting (indicated by the blue line), the PSD limit is not exceeded over the range of battery voltage values, but the transmit power drops below the PSD target when the battery voltage falls below about 2.6V.

Fig. 1(b) depicts use of a dynamic power index setting, per techniques of this disclosure. Battery voltage is measured periodically, e.g., every 60 seconds. When the battery voltage drops below a predetermined threshold, the power index value (indicated by the green line) is adjusted from a lower setting to a higher setting. In this illustrative example, based on measured characteristics of a front end transmitter, the controller is programmed to increase its power index setting to a higher value then the battery voltage falls below 2.6V.

As depicted in Fig. 1(b), the transmit power of the controller device follows transmit power characteristics associated with the lower power index setting at higher battery voltages, e.g., between about 3.3 V and about 2.6V, and follows the transmit power characteristics associated with the higher power index setting at lower battery voltages, e.g., below 2.6V. Such dynamic adjustment of transmit power via the power index adjustment enables the controller device to have a transmit power that lies between the PSD target (minimum) and the PSD limit (maximum) over a range of battery voltage values.

CONCLUSION

This disclosure describes techniques for dynamic adjustment of output power index of a wireless remote controller device based on a detected battery level of the device. The battery voltage level of the device is periodically measured. When the level falls below a predetermined threshold, the output power index is adjusted to ensure that the total transmit power from the controller device lies within a specified range. Dynamic adjustment of transmit power via the power index adjustment enables the controller device to have a transmit power that lies between the power spectral distribution (PSD) target and the PSD limit (maximum) over a range of battery voltage values.