Nonlinearity Robust Successive Requantizer

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BACKGROUND

Virtually every wireless communication systems require local oscillators for up-conversion and down-conversion of their transmitted and received signals. In most cases, the spectral purity of the local oscillator is a critical factor in overall transceiver performance, so communication standards explicitly or implicitly stipulate stringent phase noise requirements on the local oscillators. In addition to dictating the maximum acceptable phase noise power in various frequency bands, most standards require that spurious tones in the local oscillator's phase noise be highly attenuated, particularly in critical frequency bands.

Most commonly, the local oscillators are implemented as fractional-*N* PLLs. Unfortunately, spurious tones are inevitable in the phase noise of fractional-*N* PLLs, and for most wireless applications they can be sufficiently suppressed only with design tradeoffs that significantly degrade other aspects of performance. The tradeoffs tend to increase power consumption and circuit area, limit the choice of reference frequencies, and dictate low PLL bandwidths that preclude on-chip loop filters. They also become less effective in system-on-chip designs as CMOS circuit technology is scaled into the sub-100 nanometer regime. Therefore, the spurious tone problem negatively affects cost, power consumption, and manufacturability of wireless transceivers, and the problem gets worse as CMOS circuit technology scales with Moore's Law.

Surprisingly, the digital modulator in a fractional-*N* PLL is the fundamental source of spurious tones in the PLL's phase noise. This is true even though dither is used to prevent spurious tones in the modulator's quantization noise. Regardless of how dither is applied, spurious tones are induced when the modulator's quantization noise is subjected to non-linear distortion. This is particularly problematic in fractional-*N* PLLs wherein the output sequence from the modulator is converted to analog form and subjected to various non-linear operations because of non-ideal circuit behavior.

TECHNOLOGY DESCRIPTION

The invention, called a successive requantizer, is a replacement for a modulator that avoids the above-mentioned spurious tone problem, thereby circumventing the tradeoffs mentioned above. It has the potential to reduce power consumption and cost of commercial communication devices.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	7,986,250	07/26/2011	2009-036

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OTHER INFORMATION

CATEGORIZED AS

- **Communications**
  - Wireless
- **Semiconductors**
  - Materials

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