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(54) **PHASE NOISE PERFORMANCE USING MULTIPLE RESONATORS WITH VARYING QUALITY FACTORS AND FREQUENCIES**

(71) Applicant: **Skyworks Solutions, Inc.**, Irvine, CA (US)

(72) Inventors: **Aslamali A. Rafi**, Austin, TX (US); **Srisai R. Seethamraju**, Nashua, NH (US)

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(57) **ABSTRACT**

Nested phase-locked loops (PLLs) utilize resonators of different quality factors, oscillation frequencies, and tunability. A reference clock signal for a first PLL is based on a free running bulk acoustic wave (BAW) resonator. The first PLL utilizes an LC oscillator as a voltage controlled oscillator. A crystal oscillator supplies a reference clock signal to a second PLL. Feedback dividers of the first and second PLLs are coupled to the LC oscillator. A delta sigma modulator coupled to the loop filter of the second PLL controls the feedback divider of the first PLL. The first PLL utilizes a high update rate to ensure that the jitter power spectral density is spread over a wide frequency range. The nested PLL architecture allows the overall phase noise plot to follow that of the crystal resonator at low frequencies, the BAW resonator at mid-frequencies, and the LC resonator at high frequencies.