Abstracts

A new approach for a phase controlled self-oscillating mixer

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The analytical and experimental demonstration of subharmonic synchronization and phase shifting of a push-pull self-oscillating mixer is presented for the first time. Inherent high mixing gain of the self-oscillating mixer circuit is exploited to generate a strong signal at the same frequency of the reference signal, which is related to the local oscillator's (LO) phase information. A phase error between this signal and the reference signal is extracted in a phase comparator before phase locking. Analytical modeling of frequency and phase stabilization of the push-pull self-oscillating mixer is presented, which is also experimentally verified for a self-oscillating mixer at 12 GHz. This self-oscillating mixer circuit demonstrates efficient phase locking, 0/spl deg/-180/spl deg/ continuous phase shifting capability in addition to the reported large locking range (>10 MHz), low close-in to carrier phase noise (<7 dB degradation of a 6 GHz synthesized reference signal), and a high mixer conversion gain (>17 dB at 17 GHz). The demonstrated subharmonic phase locking approach replaces the need for a frequency multiplier or divider before the phase comparator. The synchronized push-pull self-oscillating mixer circuit is applicable to the millimeter-wave frequency distributed transmitters and receivers, where low-loss phase shifting and efficient subharmonic phase and frequency locking are hard to achieve.

❑ Return to main document.