

This paper presents a wideband fractional- N frequency synthesizer design with a low-effort adaptive calibration technique for  $\Sigma\Delta$  quantization noise cancellation. After adopting from the classical single-ended loop filter structure, this least mean square algorithm based calibration technique can precisely and efficiently adjust the noise cancellation digital-analog convertor current with high linearity and immunity. Besides, as long as the desired current is achieved, the calibration circuits are turned off and disconnected to save the power consumption and isolate from the signal paths. With the proposed phase-noise cancellation technique, small area and low power circuit design are achieved, meanwhile the fractional and reference spurs are highly attenuated, allowing the wideband direct frequency/phase modulation with high data rates. With low effort modification, it can be directly implemented as straightforward phase-noise enhancement for any wideband phase-locked loop applications.