Design of High-Frequency Piezoelectric Resonator-Based Cascaded Fractional-N PLL with Sub-ppb-Order Channel Adjusting Technique

$$N = \frac{f_{\text{out}}}{f_{\text{ref}}}$$

GHz Reference:
High-Frequency Piezoelectric Resonator

😊 High Q-factor, GHz resonance frequency
😢 Large process variation

$$S_{\text{out}}^2 = N^2 \times \text{(loop noise)}$$
Approach of this work

- **Cascaded PLL**
  - 1st-PLL: Frequency accuracy based on 32kHz-reference
  - 2nd-PLL: Low phase noise with GHz-reference

- **Channel adjuster**
  - N_{1st}: f_{1st} in tuning range
  - N_{2nd}: N_{total}/N_{1st}
Measurement result

- Fabricated in 65nm CMOS
- 915MHz SAW Resonator as PZR

FOM = -243.9dB
One of the best FOMs is achieved!!