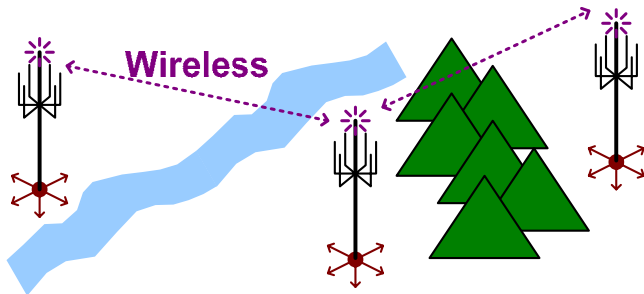


An 8-bit 600-MSps Analog-to-Digital Converter for FWA

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FWA (Fixed Wireless Access)

- Transmitting a huge amount of data by wireless in rural areas where the cost of wire construction is expensive
 - ✓ Frequency band: 38 GHz
 - ✓ Bandwidth: 200 MHz
 - ✓ Distance: about 4 km
 - ✓ Data rate: 800 Mbps by 16QAM



ADC Architecture

- Interpolate output signals of two neighbored amplifiers

✓ Merit

- Reduce a number of pre-amplifier
- ✓ Demerits on pre-amplifier
 - Response linearity of open-loop amplifier
 - * Gain flatness condition within input range
 - 10% is allowable with 0.25-LSB accuracy
 - Gain mismatch between two neighbored amplifiers
 - * Gain mismatch condition
 - 6.3% is allowable with 0.25-LSB accuracy

➤ Amplifier

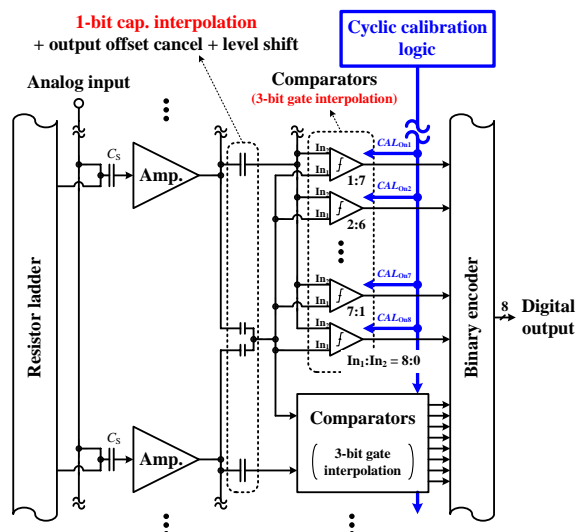
- ✓ Increase input-referred accuracy of comparators

➤ Capacitor

- ✓ 1-bit interpolation
- ✓ Remove offsets of the amplifiers

➤ Comparator

- ✓ 3-bit interpolation
- ✓ Calibrating circuit is implemented



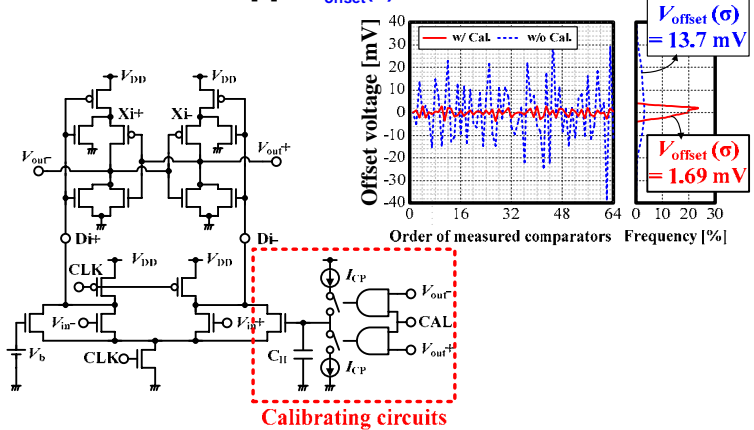
Calibration on Comparator

- Signal-to-thermal-noise robustness from sim. [1]

- ✓ $V_{noise}(\sigma) = 0.66 \text{ mV}$
 - Conventional [2] is $V_{noise}(\sigma) = 2.1 \text{ mV}$

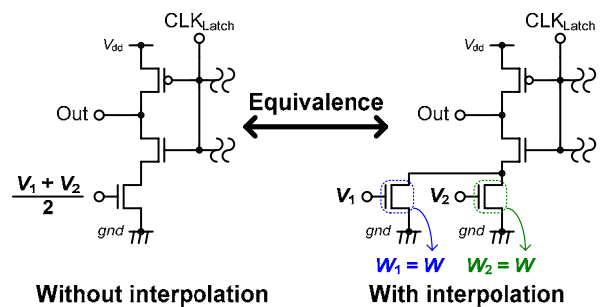
- Offset voltage from measurement results [1]

- ✓ $V_{offset}(\sigma) = 13.7 \text{ mV}$ before calibration
- ✓ $V_{offset}(\sigma) = 1.69 \text{ mV}$ after calibration
 - Conventional [2] is $V_{offset}(\sigma) = 21.5 \text{ mV}$ from sim.

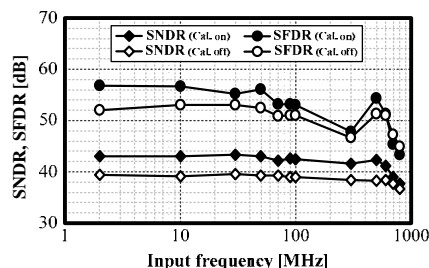
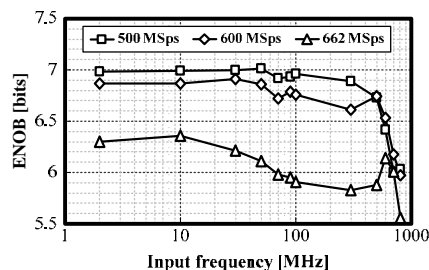


Interpolation on Comparator

- Reduce a number of pre-amplifier, S/H, and reference
 - ✓ Each number is decreased from 255 to 19
- Channel width of input MOS transistors are weighted differently
 - ✓ 3-bit interpolation is used



Measurement Results



- ENOB
 - Effective Number of Bits
 - ✓ 6.8 bits @600MSps
- ERBW
 - Effective Resolution Bandwidth
 - ✓ 600 MHz
- Effects of the cal.
 - ✓ Increase SNDR by 4 dB
- FoM
 - Figure of Merits
 - ✓ 1.54 pJ/conv.

References:
[1] M. Miyahara et al., in Proc. of ASSCC, pp 269-272, Nov., 2008.
[2] D. Schinkel et al., in ISSCC Dig. of Tech. Papers, pp.314-315, Feb., 2007.