High-Speed Analog-to-Digital Converters
for mmWave Transceivers

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1. Low interference
   - Resonance with oxygen molecules at 60 GHz
2. License-free bandwidth of 7 GHz
3. Prepare future demand for Gbps wireless transmission

mmWave

Resonance with oxygen molecules

License-free bandwidth

Research

Developing ADCs for Gbps wireless data transmission

1. Fixed Wireless Access (38 GHz)
   - Transmitting a huge amount of data in rural area
     - 8-bit flash
2. Wireless Personal Area Network (60 GHz)
   - Intended range of 10 meters of less
     - 6-bit subrange, 5-bit flash

A Fabricated 8-bit Flash ADC

- Amplifier
  - Increase input-referred accuracy of comparators
- Capacitor
  - 1-bit interpolation
  - Remove offsets of the amplifiers
- Comparator
  - 3-bit interpolation
  - Calibrating circuit is implemented
    - Charge pump

A Fabricated 6-bit Subranging ADC

- Merit of Subrange
  - Need a smaller number of comparator than the flash
- Capacitor DAC
  - Sampling for fine ADC + Subtraction
  - Linear-array DAC is used to increase speed
- Comparator
  - 2-bit interpolation
  - Calibrating circuit is implemented
    - Load capacitance

Measurement Results of the 8-bit ADC

- ENOB
  - Effective Number of Bits
    - 7.0 bits @500MSPs
- ERBW
  - Effective Resolution Bandwidth
    - 600 MHz
- Effects of the cal.
  - Increase SNDR by 4 dB
- FoM
  - Figure of Merits
    - 1.54 pJ/conv.

Measurement Results of the 6-bit ADC

- ENOB
  - Effective Number of Bits
    - 5.3 bits @700MSPs
- ERBW
  - Effective Resolution Bandwidth
    - 400 MHz
- Effects of the cal.
  - Increase SNDR by 2 dB
- FoM
  - Figure of Merits
    - 250 fJ/conv.

  - The best FoM among similar-performance ADCs
    (until June, 2009)