Towards Brain Machine Interfacing (BMI)

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System overview
- Far-field wireless
- Communicate with host
- External reader
- Power and control data
- Implanted system
- Power conversion chain
- Mixed-mode based-band signal processing
- Transmitter
- Multi-Electrode-Array (MEA)

16-Channels Oversampled Base-band
- Fully differential Embedded delta compression
  - Reduced noise folding and enhanced NEF by using OSR
  - Multi-stage amplification to reduce the silicon area and use moderate DC gain for amplifiers
  - Dedicated power scalable DM-ADC per channel

64-Channels Nyquist rate Base-band

16-Channels Oversampled Base-band

Assembly

Power supply generation and regulation
- Inductive link tuned at 1 MHz
- Fully on-chip 1.8 V LDO regulator

Digital UWB-IR Tx
- IEEE 802.15.4a compliant
- Relax Tx and challenging Rx
- All-Digital Tx architecture

Summary of performance
- Technology (CMOS): 0.18 μm
- Supply: 1.2 V
- Active recording channels: 56
- Freq-end gain: 50-64 dB
- High-pass filter: 60-350 Hz
- Input referred noise: 2.5 μV/√Hz
- ADC sampling frequency: 25 Ks
- ENOB: 7.9 bit
- ADC power consumption: 420 nW
- Reference generator power: 140 μW
- Total power dissipation: 890 μW

Digital UWB-IR Rx

Link budget
- Center frequency: 4 GHz
- Bandwidth: 1 GHz
- Modulation: B-array PPM
- Data rate: 12 Mb/s
- Link budget:
  - BER: <10-9
  - Energy efficiency: 44.7 pJ/bit
  - Total Power consumption: 536 μW

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