Enhanced Narrowband IoT (eNB-IoT)
Design and Implementation
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Double Connected Devices

Limitations of existing NB-IoT:
- Each device occupies signal bandwidth of 180 kHz.
- More devices require more spectral resources.
- Benefits of eNB-IoT:
  - Each device occupies half bandwidth, which is 90 kHz.
  - Bit error rate performance is maintained the same.
  - System complexity is maintained the same.

Further Extension of Signal Coverage

Limitations of existing NB-IoT:
- Repetitive transmission results in extra power consumption and time delay.
- Frequency hopping results in frequency offset.
- Coherence time is violated due to each hop.
- Benefits of eNB-IoT:
  - Locate the optimal frequency portion associated with high SNR (energy efficient resource allocation).

Further Improvement of Data Rate

Limitations of existing NB-IoT:
- Maximum supported modulation format is QPSK.
  - For data-driven applications, QPSK is not sufficient.
  - Benefits of eNB-IoT:
    - Data rate can be improved without changing modulation formats.

Half-Sinc Single-Tone Waveform

Limitations of existing NB-IoT:
- Hilbert transform is straightforward and complexity is reasonable.
- No extra time-domain samples are introduced.

Robust to frequency offset due to the protection gap

This simulation figure shows that using the adaptive spectrum selection technique, in order to achieve the same BER performance, eNB-IoT requires lower transmit signal power. The saved powers can be used to extend signal coverage such as deep indoor communications (e.g., basement) where signals are weak.