# PN Sequences for Uplink Channel Sounding for TDD OFDMA

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Purpose:

This is a response to a call for contribution to 802.16e

# CSIT into 802.16e C80216e-04_318r1

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# The Need

- Contribution C80216e-04_263r1 provides sounding mechanism but does not specify the sequences used for the modulation.
- Three relevant modes:
  - Occupation of a block of adjacent subcarriers.
  - Occupation of decimated subcarriers (equally spaced).
  - Occupation of downlink permutation subcarriers (for example PUSC).

# The Need (cont.)

- When orthogonal methods to discriminate among mobiles are used, properties such as correlation are less important.
- We propose low PAPR sequences with complexity of production lower than GCL.

# Performance

- PAPR: About 5dB.
- Does not require multiplications for the production of the sequences.

# The Proposed Sequences

- Keep a single 2 **Kbit** sequence in memory. This is a complementary sequence produced by Golay rule of expension.
- Use BPSK modulation with bits taken from the sequence. Location start is length dependent (hold in LUT).

# Reduced Storage Complexity

- For mode of adjacent subcarrier covering up to 1728/4=432 subcarriers, use a single offset (FFT size dependent) to determine sequence start.
- Achieves worst case 6dB PAPR vs. 5dB PAPR of length dependent offsets.

# Backup

# Complementary Sequences

$$R_X(k) + R_Y(k) = 2N\delta(k)$$

X and Y are complementary if

$$S_X(f) + S_Y(f) = 2N$$

$$E\left[|X_k|^2\right] = 1$$

$$PAPR \le \frac{2N}{N} = 2 \Rightarrow 3dB$$

# Golay rule of expension

$$A_1 = [1,1] \; B_1 = [1,-1]$$

$$A_n = [A_n, B_n] \; B_n = [A_n, -B_n]$$