Enhanced MIMO support for Cellular OFDMA Systems using Midambles

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Purpose: Adoption of proposed changes into P802.16e-D5

Enhanced MIMO support for Cellular OFDMA Systems using Midambles

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Introduction

- Goal: To improve channel estimation and tracking in MIMO OFDMA systems
- The preamble is transmitted from a single antenna in the current draft for 802.16e
- First symbol of MIMO zone of the DL sub-frame
- Simple PN sequence, low PAPR, good cross-correlation property
- Support for various FFT sizes and 2,3,4 Tx antennas in both FUSC and PUSC
- Purely optional and no impact on SISO SS

Midamble Structure

- FUSC or optional FUSC
  - The transmit antennas use non-overlapping subcarriers
  - DC carrier is nulled prior to transmission.
- Number of BS antennas is 2 : Antenna n transmits on subcarriers, $-(N_{used}/2)+n+2k$
- Number of BS antennas is 3 or 4 : Antenna n transmits on subcarriers, $-(N_{used}/2)+n+4k$

where:

N_t	is the number of transmit antennas
n	is the antenna index $1,\ldots, N_t-1$
k	is the sub-carrier running index

Midamble Structure

- Example: N_t =4

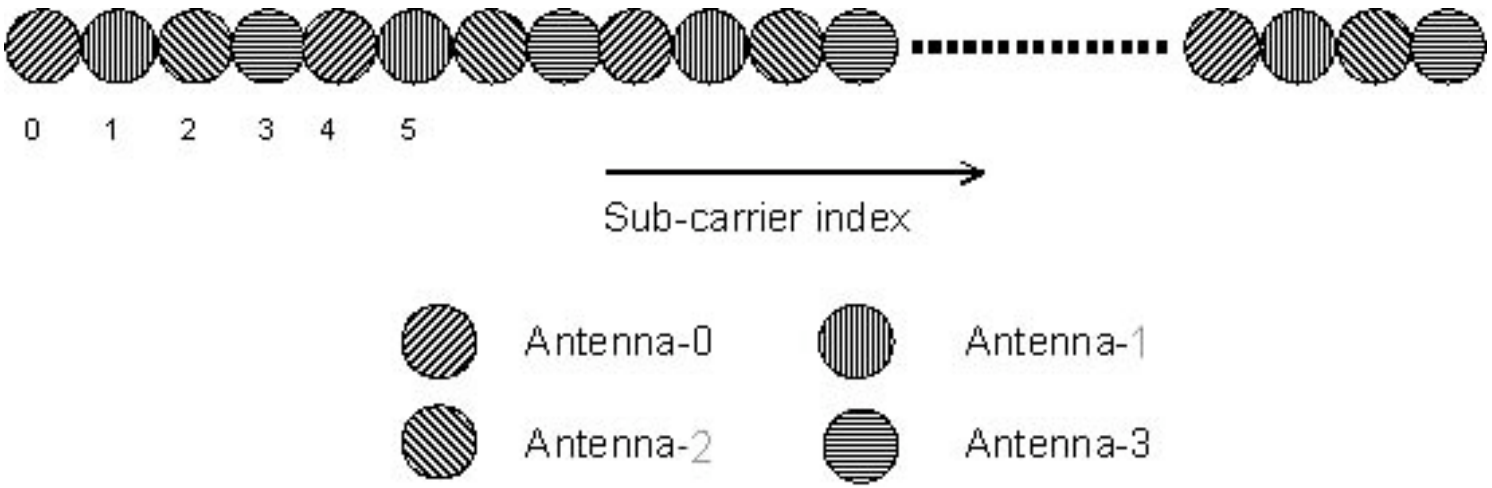

Figure xxxx. Midamble FUSC structure (frequency domain)

Midamble Structure

- PUSC
  - The subchannel permutations and grouping remains same as for the data subchannel
  - Instead all the subcarriers are used as pilots.

- Midamble_Carrier_Set : $-(N_{used}/2) + n + N_t\, k$

  where:

  N_t is the number of transmit antennas
  n is the antenna index $1,\ldots, N_t\text{-}1$
  k is the sub-carrier running index

Midamble Structure

- Example: N_t =4

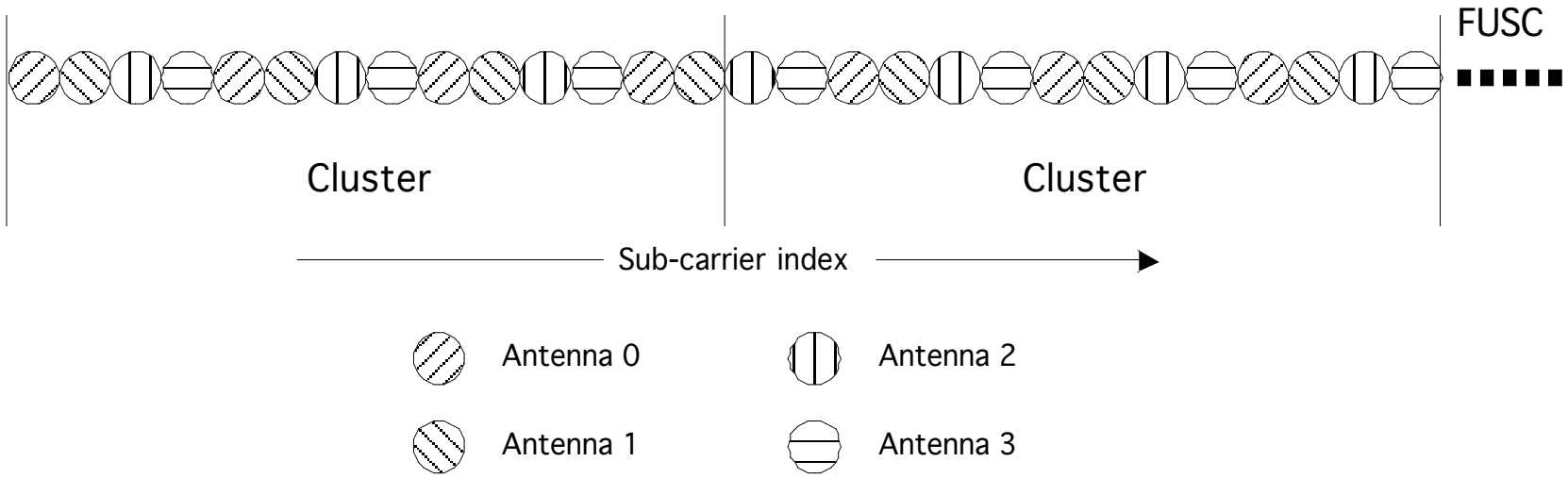

Figure yyyy. Midamble PUSC structure (frequency domain)

Midamble Sequence

- FUSC or optional FUSC

$$q_{ID_{cell}}[m] = \begin{cases} R(8*\left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9), & where \quad m \mod 9 = 0,1,\ldots,7 \\ T(\left\lfloor \frac{m}{9} \right\rfloor), & where \quad m \mod 9 = 8 \end{cases} \qquad m = 0,1,\ldots, \frac{N_{used}}{2*\left\lceil \frac{N_t}{2} \right\rceil} - 1$$

$$R_1(r) = H_{128}(ID_{cell}+1, \prod_{\left\lfloor \frac{r}{128} \right\rfloor}(r \bmod 128)), \quad r = 8*\left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9 = 0,1,\ldots,N_r - 1$$

$$R_2(r) = B_{ID_{cell}+1} g_{\prod(r)}, r = 8*\left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9 = 0,1,\ldots,N_r - 1$$

- The sequence $T(k)$ is determined by IDcell and should be chosen to achieve low PAPR

Midamble Sequence

- PUSC
  - The midamble sequence for PUSC shall be obtained from the corresponding sequence used in the FUSC or optional FUSC for the relevant FFT size and number of antennas.
  - For PUSC, however, all the used subcarriers shall further be clustered and divided into different segments as in the data traffic region