Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**A common preamble sequence for OMI identification and for FFT sizes other than 2048**	
Date Submitted	**2004-08-24**	
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Re:	IEEE 802.16e D4 Draft	
Abstract	Addition of a common SYNC symbol to aid in fast cell search.	
Purpose	To incorporate the changes here proposed into the 802.16e D5 draft.	
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A Preamble Sequence for Common SYNC Symbol for FFT sizes other than 2048

1 Background

In contribution document C80216e, the common SYNC symbol is specified for various FFT sizes. In this contribution we proposed a structural way to generate the common SYNC symbol based on Chu and Frank-Zadoff CAZAC sequences and introduce spectrum folding to ensure low PAPR.

2 Proposed Solution

For theoretical derivations using CAZAC sequences in the construction of preamble sequences, please refer to contribution document C80216e-04_265.

3 Proposed Text Change

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8.4.6.1.1 Preamble

The sequence for the common SYNC symbol is defined below.

Table xxx. Common SYNC symbol

FFT size	1024	512	128
Length of sequence	512	256	64
Sequence type	Frank-Zadoff	Chu	Chu
Sequence length	256	128	32

Table xxx – Operating mode configuration

OMI index for common SYNC symbol	Operating mode
0 (default)	PUSC
1	FUSC
2	Optional FUSC
3	AMC

For the FFT sizes of 1024, 512, and 128, the common SYNC symbols are derived from Fran-Zadoff [xx] or Chu [xx] sequences and possess CAZAC (Constant Amplitude Zero Auto-correlation) properties.

The Chu sequence generation is expressed as

(x)

The Frank-Zadoff sequence generation is expressed as

The common SYNC symbol modulates each 2'nd subcarrier with modified CAZAC sequences and uses legacy preamble boosting formula described in 8.4.9.4.3.1. Figure X depicts an example of the subcarrier modulation.

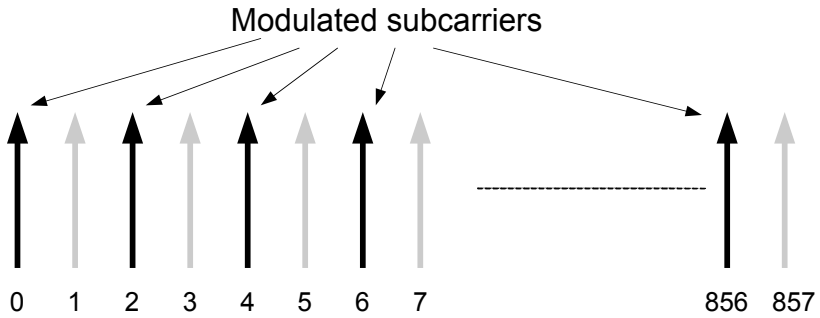

Figure X. Common SYNC symbol basic structure

8.4.6.1.1.1 1024-FFT OFDMA DL Common SYNC Symbol Generation

The common SYNC modulation data of 1024 physical subcarriers are assembled in such a way that the folded frequency spectrum of even-numbered subcarriers of the 2x subsampled time waveform closely resembles a 256-element Frank-Zadoff sequence while maintaining constant amplitude. The assembling process uses a 256-element Frank-Zadoff sequence described in the last section and the procedures are

where

and *OMI* is between 0 and 3 as is defined in X.X.X.X. and are the numbers of guard subcarriers on the left- and right-hand sides, respectively, as defined in Table 309b. is a 256-element Chu sequence defined earlier in (x).

8.4.6.1.1.2 512-FFT OFDMA DL Common SYNC Symbol Generation

The common SYNC modulation data of 512 physical subcarriers are assembled in such a way that the folded frequency spectrum of even-numbered subcarriers of the 2x subsampled time waveform closely resembles a 128-element Chu sequence while maintaining constant amplitude. The assembling process uses a 128-element Chu sequence described in the last section and the procedures are

where

and *OMI* is between 0 and 3 as is defined in X.X.X.X. and are the numbers of guard subcarriers on the left- and right-hand sides, respectively, as defined in Table 309c. is a 128-element Chu sequence defined earlier in (x).

8.4.6.1.1.3 128-FFT OFDMA DL Common SYNC Symbol Generation

The common SYNC modulation data of 128 physical subcarriers are assembled in such a way that the folded frequency spectrum of even-numbered subcarriers of the 2x subsampled time waveform closely resembles a 32-element Chu sequence while maintaining constant amplitude. The assembling process uses a 32-element Chu sequence described in the last section and the procedures are

where

and *OMI* is between 0 and 3 as is defined in X.X.X.X. and are the numbers of guard subcarriers on the left- and right-hand sides, respectively, as defined in Table 309d. is a 32-element Chu sequence defined earlier in (x).

----------End text ----------

4 References

[1] IEEE P802.16-REVe/D4-2004 Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Band.

[2] IEEE C80216e-04_265, Preamble Sequence For Fast Cell Search, Low Computational Complexity, and Low PAPR