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Re:	Contribution supporting TGe WG ballot #14b
Abstract	Enhancements with MIMO Midambles for Cellular OFDMA Systems
Purpose	Adoption of proposed changes into P802.16e ~~Crossed-out indicates deleted text,~~ underlined blue indicates new text change to the Standard, and underlined green indicates newly added text from the original contribution
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Release	
Patent Policy and Procedures	

Enhancements with MIMO Midambles for Cellular OFDMA Systems

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1. Introduction

Current draft standard [1] specifies that the preamble is transmitted from a single antenna and does not provide a way to efficiently estimate multiple channels for multiple BS antennas. Allowing multiple preamble transmission offers performance gain for MIMO SS while degrades performances of SISO SS due to the reduced power per antenna. Therefore, in case of MIMO and non-MIMO SS coexist within a cell, multiple preamble transmission does not always guarantee the overall performance improvement. This contribution tries to tackle this problem and offers a solution that improves MIMO performance, especially for high mobility MIMO SS, but has little impact on non-MIMO SS at the same time.

It is assumed in the current standard that MIMO SS estimates the channel and tracks the time offsets as well as frequency offsets just by utilizing the sparsely scattered pilots inside the frame. The reality is, however, tracking of the time/frequency offsets with the error-prone estimated channels is often far from being ideal, especially for highly mobile SS. This problem is aggravated when the number of BS transmit antennas increases and the pilot density per antenna decreases. Therefore, the need of introducing a mechanism which insures good channel tracking and estimation arises.

The suggested remedy we propose is to use a midamble within a frame which is transmitted from all antennas. The ability to measure the channel quality in the entire bandwidth is particularly needed for band AMC operation, where each SS scans the entire frequency bandwidth and selects the best band to be used in the subsequent frames. Since the channels seen from different transmit antennas are more or less uncorrelated, choosing the best band based only on a channel from a single transmit antenna is far from being optimal. It is believed the MIMO midamble should provide robust starting point, after which pilot-aided (and decision-aided) channel tracking may be employed.

The proposed midamble features low PAPR characteristic and can differentiate up to 127 BS with up to 4 antennas each. Scalability is also considered and midamble sets for different FFT sizes (2048, 1024) are provided. The orthogonality between different antennas is maintained by disjoint sets of subcarriers dedicated to each antenna.

In this contribution, the midamble is placed at the first symbol in a specialized zone such as STC zone in the downlink. The proposed sets of midambles demonstrate low PAPR (see IEEE C802.16e-04/188 for complete PAPR performance). In order to keep backward compatibility with IEEE 802.16d standard [2], a reserved bit in STC_Zone_IE is used to indicate the presence of this midamble.

~~Current draft standard specifies preamble only for single antenna transmission, and does not provide a way to efficiently estimate channels from multiple BS antennas. The ability to measure the channel quality in the entire bandwidth is particularly needed for band AMC operation, where each SS scans the entire frequency bandwidth and selects the best band to be used in the subsequent frames. Since the channels seen from different transmit antennas are more or less uncorrelated, choosing the best band based only on a channel from a single transmit antenna is far from being optimal.~~

~~In this contribution, this problem is addressed by introducing midamble at the first symbol in a specialized zone such as STC zone in the downlink. This new set of midambles for different FFT sizes are differentiated by different transmit antennas as well as different BS, and an indicator bit is inserted in STC_Zone_IE to indicate the presence of this midamble.~~

2. MIMO Midamble

2.1. STC Zone IE format

[Modify the Table 277a in Section 8.4.5.3.4 in page 73 in [1]]

Table 277a -OFDMA downlink STC_ZONE IE format

Syntax	Size (bits)	Notes
STC_ZONE_IE() {		
Extended DIUC	4	STC/ZONE=0x01
Length	4	Length = 0x02
Permutation	2	00 = PUSC permutation 01 = FUSC permutation 10 = Optional FUSC permutation 11 = Optional adjacent subcarrier permutation
Use All SC indicator	1	0 = Do not use all subchannels 1 = Use all subchannels
STC	2	00 = No STC STC using 2 antennas 01 = STC using 23 antennas 10 = STC using 4 antennas 11 = FHDC using 2 antennas
Matrix indicator	2	Antenna STC/FHDC matrix (see 8.4.8) 00 = Matrix A 01 = Matrix B 10 = Matrix C (applicable to 4 antennas only) 11 = Matrix D (applicable to 4 antennas only) Reserved
Idcell	6	
Midamble presence	1	0 = not present 1 = present at the first symbol in STC zone
Reserved	23	Shall be set to zero
}		

2.2. MIMO Midamble Sequences

[Add a new section 8.4.8.3.6]

8.4.8.3.6 MIMO Midamble Sequences

For the optional FUSC and optional AMC zones in the downlink, a midamble may be inserted at the first symbol in the STC zone defined by STC_Zone_IE() in order to measure channel quality from different BS antennas. In spectrum perspective a midamble comprises the subcarriers with even-numbered Frequency Offset Indices every n^{th} frequency indices for n-antenna BS, except for 3-antenna BS, where every 4^{th} frequency indices are not used.

8.4.8.3.6.1 Midamble Sequences for 2-Antenna BS

For the 2 Tx Antenna, the frequency locations and corresponding values of the subcarriers in a midamble are defined as in the following formula.

$$P_{ID_{cell,s}}\left[k_{foi}\right]=\begin{cases}\left(1-2q_{ID_{cell}}[m]\right) & k_{foi}=2m-\frac{N_{used}}{2}+s, m=0,1,\ldots,\frac{N_{used}}{4}-1\\ \left(1-2q_{ID_{cell}}[m-1]\right) & k_{foi}=2m-\frac{N_{used}}{2}+s, m=\frac{N_{used}}{4}+1,\frac{N_{used}}{4}+2,\ldots,\frac{N_{used}}{2}-1\\ 0, & otherwise\end{cases} \quad (1)$$

$$ID_{cell}\in\{0,1,\ldots,126\}, s\in\{0,1\}, k_{foi}\in\{-N_{FFT}/2,-N_{FFT}/2+1,\ldots,N_{FFT}/2-1\}$$

The frequency-domain sequence $P_{ID_{cell,s}}[k_{foi}]$ in the above equation has a property that, when applied to IFFT at a transmitter, it is transformed to a time-domain sequence, the latter half of which is a replica of the first one. The factor $\sqrt{2}$ is used to maintain the average power of a downlink midamble to the same level of that of other non-midamble OFDMA symbols. $q_{ID_{cell}}[m]$ is defined as follows.

[FFT size = 2048]

$$q_{ID_{cell}}[m]=\begin{cases}R(16*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 18), & where\ \ m\bmod 18=0,1,\ldots,15\\ T(2*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 2), & where\ \ m\bmod 18=16,17\end{cases} \quad m=0,1,\ldots,862 \quad (2)$$

$$R(r)=H_{128}(ID_{cell}+1, \prod_{\left\lfloor\frac{r}{128}\right\rfloor}(r\bmod 128)), \quad r=16*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 18=0,1,\ldots,767$$

[FFT size = 1024]

$$q_{ID_{cell}}[m]=\begin{cases}R(16*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 18), & where\ \ m\bmod 18=0,1,\ldots,15\\ T(2*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 2), & where\ \ m\bmod 18=16,17\end{cases} \quad m=0,1,\ldots,430 \quad (3)$$

$$R(r)=H_{128}(ID_{cell}+1, \prod_{\left\lfloor\frac{r}{128}\right\rfloor}(r\bmod 128)), \quad r=16*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 18=0,1,\ldots,383$$

[FFT size = 512]

$$q_{ID_{cell}}[m]=\begin{cases}R(8*\left\lfloor\frac{m}{9}\right\rfloor+m\bmod 9), & where\ \ m\bmod 9=0,1,\ldots,7\\ T(\left\lfloor\frac{m}{9}\right\rfloor), & where\ \ m\bmod 9=8\end{cases} \quad m=0,1,\ldots,214 \quad (4)$$

$$R(r)=H_{128}(ID_{cell}+1, \prod_{\left\lfloor\frac{r}{128}\right\rfloor}(r\bmod 128)), \quad r=8*\left\lfloor\frac{m}{9}\right\rfloor+m\bmod 9=0,1,\ldots,191$$

A sequence $T(k)$ is determined by IDcell and ~~s and should be chosen to achieve low PAPR. $w_n^s \in \{0,1\}$ denotes the n-th value of the s-th Walsh sequence of length 8, where n is [0,7]. s is the antenna index.~~ should be chosen to achieve low PAPR. $H_{128}(i,j)$ denotes the number at (i, j) of a 128 by 128 Walsh Hadamard matrix, where $i,j = 0,1,\ldots,127$. The first row vector of H_{128} is the all-one sequence and shall not be used. $\prod_{\lfloor \frac{m}{128} \rfloor}(l), l = 0,1,\ldots,127$ is the l-th value of the $\lfloor m/128 \rfloor$-the permutation out of ~~three~~ six predefined permutations shown in Table aaa.

Table aaa – Permutation $(l = 0,1,\ldots,127)$

$\prod_0(l)$	1, 65, 97, 113, 121, 125, 127, 126, 63, 94, 47, 86, 43, 84, 42, 21, 75, 100, 50, 25, 77, 103, 114, 57, 93, 111, 118, 59, 92, 46, 23, 74, 37, 83, 104, 52, 26, 13, 71, 98, 49, 89, 109, 119, 122, 61, 95, 110, 55, 90, 45, 87, 106, 53, 91, 108, 54, 27, 76, 38, 19, 72, 36, 18, 9, 69, 99, 112, 56, 28, 14, 7, 66, 33, 81, 105, 117, 123, 124, 62, 31, 78, 39, 82, 41, 85, 107, 116, 58, 29, 79, 102, 51, 88, 44, 22, 11, 68, 34, 17, 73, 101, 115, 120, 60, 30, 15, 70, 35, 80, 40, 20, 10, 5, 67, 96, 48, 24, 12, 6, 3, 64, 32, 16, 8, 4, 2, 0
$\prod_1(l)$	25, 77, 103, 114, 57, 93, 111, 118, 59, 92, 46, 23, 74, 37, 83, 104, 52, 26, 13, 71, 98, 49, 89, 109, 119, 122, 61, 95, 110, 55, 90, 45, 87, 106, 53, 91, 108, 54, 27, 76, 38, 19, 72, 36, 18, 9, 69, 99, 112, 56, 28, 14, 7, 66, 33, 81, 105, 117, 123, 124, 62, 31, 78, 39, 82, 41, 85, 107, 116, 58, 29, 79, 102, 51, 88, 44, 22, 11, 68, 34, 17, 73, 101, 115, 120, 60, 30, 15, 70, 35, 80, 40, 20, 10, 5, 67, 96, 48, 24, 12, 6, 3, 64, 32, 16, 8, 4, 2, 1, 65, 97, 113, 121, 125, 127, 126, 63, 94, 47, 86, 43, 84, 42, 21, 75, 100, 50, 0
$\prod_2(l)$	71, 98, 49, 89, 109, 119, 122, 61, 95, 110, 55, 90, 45, 87, 106, 53, 91, 108, 54, 27, 76, 38, 19, 72, 36, 18, 9, 69, 99, 112, 56, 28, 14, 7, 66, 33, 81, 105, 117, 123, 124, 62, 31, 78, 39, 82, 41, 85, 107, 116, 58, 29, 79, 102, 51, 88, 44, 22, 11, 68, 34, 17, 73, 101, 115, 120, 60, 30, 15, 70, 35, 80, 40, 20, 10, 5, 67, 96, 48, 24, 12, 6, 3, 64, 32, 16, 8, 4, 2, 1, 65, 97, 113, 121, 125, 127, 126, 63, 94, 47, 86, 43, 84, 42, 21, 75, 100, 50, 25, 77, 103, 114, 57, 93, 111, 118, 59, 92, 46, 23, 74, 37, 83, 104, 52, 26, 13, 0
$\prod_3(l)$	69, 99, 112, 56, 28, 14, 7, 66, 33, 81, 105, 117, 123, 124, 62, 31, 78, 39, 82, 41, 85, 107, 116, 58, 29, 79, 102, 51, 88, 44, 22, 11, 68, 34, 17, 73, 101, 115, 120, 60, 30, 15, 70, 35, 80, 40, 20, 10, 5, 67, 96, 48, 24, 12, 6, 3, 64, 32, 16, 8, 4, 2, 1, 65, 97, 113, 121, 125, 127, 126, 63, 94, 47, 86, 43, 84, 42, 21, 75, 100, 50, 25, 77, 103, 114, 57, 93, 111, 118, 59, 92, 46, 23, 74, 37, 83, 104, 52, 26, 13, 71, 98, 49, 89, 109, 119, 122, 61, 95, 110, 55, 90, 45, 87, 106, 53, 91, 108, 54, 27, 76, 38, 19, 72, 36, 18, 9, 0
$\prod_4(l)$	102, 51, 88, 44, 22, 11, 68, 34, 17, 73, 101, 115, 120, 60, 30, 15, 70, 35, 80, 40, 20, 10, 5, 67, 96, 48, 24, 12, 6, 3, 64, 32, 16, 8, 4, 2, 1, 65, 97, 113, 121, 125, 127, 126, 63, 94, 47, 86, 43, 84, 42, 21, 75, 100, 50, 25, 77, 103, 114, 57, 93, 111, 118, 59, 92, 46, 23, 74, 37, 83, 104, 52, 26, 13, 71, 98, 49, 89, 109, 119, 122, 61, 95, 110, 55, 90, 45, 87, 106, 53, 91, 108, 54, 27, 76, 38, 19, 72, 36, 18, 9, 69, 99, 112, 56, 28, 14, 7, 66, 33, 81, 105, 117, 123, 124, 62, 31, 78, 39, 82, 41, 85, 107, 116, 58, 29, 79, 0
$\prod_5(l)$	70, 35, 80, 40, 20, 10, 5, 67, 96, 48, 24, 12, 6, 3, 64, 32, 16, 8, 4, 2, 1, 65, 97, 113, 121, 125, 127, 126, 63, 94, 47, 86, 43, 84, 42, 21, 75, 100, 50, 25, 77, 103, 114, 57, 93, 111, 118, 59, 92, 46, 23, 74, 37, 83, 104, 52, 26, 13, 71, 98, 49, 89, 109, 119, 122, 61, 95, 110, 55, 90, 45, 87, 106, 53, 91, 108, 54, 27, 76, 38, 19, 72, 36, 18, 9, 69, 99, 112, 56, 28, 14, 7, 66, 33, 81, 105, 117, 123, 124, 62, 31, 78, 39, 82, 41, 85, 107, 116, 58, 29, 79, 102, 51, 88, 44, 22, 11, 68, 34, 17, 73, 101, 115, 120, 60, 30, 15, 0

8.4.8.3.6.2 Midamble Sequences for 3-Antenna BS

For the 3 Tx Antenna, the frequency locations and corresponding values of the subcarriers in a midamble are defined as in the following formula.

$$P_{ID_{cell},s}\left[k_{foi}\right]=\begin{cases}\sqrt{\frac{4}{3}}\cdot\left(1-2q_{ID_{cell}}[m]\right) & k_{foi}=4m-\frac{N_{used}}{2}+s, m=0,1,\ldots,\frac{N_{used}}{8}-1\\ \sqrt{\frac{4}{3}}\cdot\left(1-2q_{ID_{cell}}[m-1]\right) & k_{foi}=4m-\frac{N_{used}}{2}+s, m=\frac{N_{used}}{8}+1,\frac{N_{used}}{8}+2,\ldots,\frac{N_{used}}{4}-1\\ 0, & otherwise\end{cases} \quad (5)$$

$$ID_{cell}\in\{0,1,\ldots,126\}, s\in\{0,1,2\}, k_{foi}\in\{-N_{FFT}/2,-N_{FFT}/2+1,\ldots,N_{FFT}/2-1\}$$

The factor $\sqrt{\frac{4}{3}}$ is used to maintain the average power of a downlink midamble to the same level of that of other non-midamble OFDMA symbols. $q_{ID_{cell}}[m]$ is defined as follows.

[FFT size = 2048]

$$q_{ID_{cell}}[m]=\begin{cases}R(16*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 18), & where\ m\ \bmod 18=0,1,\ldots,15\\ T(2*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 2), & where\ m\ \bmod 18=16,17\end{cases} \quad m=0,1,\ldots,430 \quad (5)$$

$$R(r)=H_{128}(ID_{cell}+1,\ \prod_{\left\lfloor\frac{r}{128}\right\rfloor}(r\bmod 128)),\quad r=16*\left\lfloor\frac{m}{18}\right\rfloor+m\bmod 18=0,1,\ldots,383$$

[FFT size = 1024]

$$q_{ID_{cell}}[m]=\begin{cases}R(8*\left\lfloor\frac{m}{9}\right\rfloor+m\bmod 9), & where\ m\ \bmod 9=0,1,\ldots,7\\ T(\left\lfloor\frac{m}{9}\right\rfloor), & where\ m\ \bmod 9=8\end{cases} \quad m=0,1,\ldots,214 \quad (6)$$

$$R(r)=H_{128}(ID_{cell}+1,\ \prod_{\left\lfloor\frac{r}{128}\right\rfloor}(r\bmod 128)),\quad r=8*\left\lfloor\frac{m}{9}\right\rfloor+m\bmod 9=0,1,\ldots,191$$

A sequence $T(k)$ and the permutation $\prod_{\left\lfloor\frac{m}{128}\right\rfloor}(l), l=0,1,\ldots,127$ are the same as defined in 8.4.8.3.6.1.

[FFT size = 512]

$$q_{ID_{cell}}[m]=\begin{cases}R(8*\left\lfloor\frac{m}{9}\right\rfloor+m\bmod 9), & where\ m\ \bmod 9=0,1,\ldots,7\\ T(\left\lfloor\frac{m}{9}\right\rfloor), & where\ m\ \bmod 9=8\end{cases} \quad m=0,1,\ldots,106$$

$$R(r) = B_{ID_{cell}+1} g_{\prod(r)}, r = 8 * \left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9 = 0,1,\ldots 95$$

where the $k, 1 \le k \le$ can be converted into binary as $b_6 b_5 b_4 b_3 b_2 b_1 b_0$, define b_6 as MSB, b_0 as LSB, B_k is a low vector to represent $B_k = [b_0 b_1 b_2 b_3 b_4 b_5 b_6]$. The $g_u, 0 \le u \le 95$ is u th column vector of the following generator matrix G

$$G = [g_0 g_1 \ldots g_{95}] = \begin{bmatrix} 01010101010101010001000100010000010101100011000000110101011000000000111111110000111100001111 \\ 001100110011001101010101010101010001000100010001000001010110001100000011010101100000000011111111 \\ 000011110000111100110011001100110101010101010101000100010001000100000101011000110000001101010110 \\ 000000001111111100001111000011110011001100110011010101010101010100010001000100010000010101100011 \\ 000000110101011000000000111111110000111100001111001100110011001101010101010101010001000100010001 \\ 000001010110001100000011010101100000000011111111000011110000111100110011001100110101010101010101 \\ 000100010001000100000101011000110000001101010110000000001111111100001111000011110011001100110011 \end{bmatrix}$$

$B_k g_u$ is an inner product of (1×7) row vector and (7×1) column vector.

$\prod(l), l = 0,1,\ldots 95$ is shown in Table bbb as following

Table bbb – Permutation $(l = 0,1,\ldots,95)$

$\prod(l)$	8,1,9,12,15,10,11,4,6,13,2,14,0,5,3,7,31,19,18,20,17,27,28,30,22,24,21,16,29,25,26,23,35,41,40,39,42,46,37,43,33,44,36,32,47,34,45,38,63,59,61,50,54,52,56,51,58,62,55,53,49,60,57,48,64,72,67,71,76,69,65,70,75,79,73,78,66,74,68,77,80,84,81,95,82,88,87,89,83,92,93,86,94,91,90,85

8.4.8.3.6.3 Midamble Sequences for 4-Antenna BS

For the 4-antenna BS, the frequency locations and corresponding values of the subcarriers in a midamble are defined as in the following formula.

$$P_{ID_{cell},s}[k_{foi}] = \begin{cases} (1 - 2q_{ID_{cell}}[m]) & k_{foi} = 4m - \frac{N_{used}}{2} + s, m = 0,1,\ldots,\frac{N_{used}}{8} - 1 \\ (1 - 2q_{ID_{cell}}[m-1]) & k_{foi} = 4m - \frac{N_{used}}{2} + s, m = \frac{N_{used}}{8} + 1, \frac{N_{used}}{8} + 2, \ldots, \frac{N_{used}}{4} - 1 \\ 0, & otherwise \end{cases} \quad (5)$$

$$ID_{cell} \in \{0,1,\ldots,126\}, s \in \{0,1,2,3\}, k_{foi} \in \{-N_{FFT}/2, -N_{FFT}/2+1, \ldots, N_{FFT}/2-1\}$$

$q_{ID_{cell}}[m]$ is defined as follows:

[FFT size = 2048]

$$q_{ID_{cell}}[m] = \begin{cases} R(16*\left\lfloor \frac{m}{18} \right\rfloor + m \bmod 18), & where \quad m \quad \bmod 18 = 0,1,\ldots,15 \\ T(2*\left\lfloor \frac{m}{18} \right\rfloor + m \bmod 2), & where \quad m \quad \bmod 18 = 16,17 \end{cases} \qquad m = 0,1,\ldots,430 \qquad (5)$$

$$R(r) = H_{128}(ID_{cell}+1, \prod_{\left\lfloor \frac{r}{128} \right\rfloor}(r \bmod 128)), \quad r = 16*\left\lfloor \frac{m}{18} \right\rfloor + m \bmod 18 = 0,1,\ldots,383$$

[FFT size = 1024]

$$q_{ID_{cell}}[m] = \begin{cases} R(8*\left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9), & where \quad m \quad \bmod 9 = 0,1,\ldots,7 \\ T(\left\lfloor \frac{m}{9} \right\rfloor), & where \quad m \quad \bmod 9 = 8 \end{cases} \qquad m = 0,1,\ldots,214 \qquad (6)$$

$$R(r) = H_{128}(ID_{cell}+1, \prod_{\left\lfloor \frac{r}{128} \right\rfloor}(r \bmod 128)), \quad r = 8*\left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9 = 0,1,\ldots,191$$

A sequence $T(k)$ and the permutation $\prod_{\left\lfloor \frac{m}{128} \right\rfloor}(l), l = 0,1,\ldots,127$ are the same as defined in 8.4.8.3.6.1.

[FFT size = 512]

$$q_{ID_{cell}}[m] = \begin{cases} R(8*\left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9), & where \quad m \quad \bmod 9 = 0,1,\ldots,7 \\ T(\left\lfloor \frac{m}{9} \right\rfloor), & where \quad m \quad \bmod 9 = 8 \end{cases} \qquad m = 0,1,\ldots,106$$

$$R(r) = B_{ID_{cell}+1} g_{\prod(r)}, r = 8*\left\lfloor \frac{m}{9} \right\rfloor + m \bmod 9 = 0,1,\ldots 95$$

where the $k, 1 \le k \le$ can be converted into binary as $b_6 b_5 b_4 b_3 b_2 b_1 b_0$, define b_6 as MSB, b_0 as LSB, B_k is a low vector to represent $B_k = [b_0 b_1 b_2 b_3 b_4 b_5 b_6]$. The $g_u, 0 \le u \le 95$ is u th column vector of the generator matrix G in **8.4.8.3.6.2**

$B_k g_u$ is an inner product of (1×7) row vector and (7×1) column vector.

$\prod(l), l = 0,1,\ldots 95$ is shown in Table bbb in **8.4.8.3.6.2**

References:

[1] IEEE P802.16e/D3 Air Interface for Fixed and Mobile Broadband Wireless Access Systems – Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands

[2] IEEE P802.16-REVd/D5-2004 Draft IEEE Standards for local and metropolitan area networks part 16: Air interface for fixed broadband wireless access systems

Appendix

Table 1. $T(k), k = 2*\left\lfloor \frac{m}{18} \right\rfloor + m \bmod 2 = 0,1,2,\ldots,94$ (2-Tx, N=2048)
(last bit should be ignored)

ID cell	sequence	papr	ID cell	sequence	papr
0	CB77075FC4E595C61C650ED8	6.22165	64	5D8D0DE835A5BB31C555390F	5.84631
1	B668CA10178238581C775ED5	6.35344	65	04015C24F4597CF8B3FD9AE2	6.58931
2	E425870E83DA3BC8D6ABAD8A	6.27542	66	E8DF85F835A8376992A4EF06	6.12357
3	CD182D4096FCA43378A1FCDE	6.1957	67	963BC04D0BF89A4EFA38AEC2	6.2017
4	6DB1DECBAF16028424629A81	6.61497	68	8178D6727ECE4846BFC2E5D1	6.27209
5	D5F86FC51EF9AB687D1D7C51	6.10128	69	4B42B8833DBF7FD045389810	5.95606
6	42C7485C088055E620C703B7	6.06191	70	7F123B95FF2FECFDCE043A09	6.21315
7	95773AE2F2F5FDCB884EA608	6.05522	71	C9911F28A35F025AAED75FF1	6.00232
8	ACEA15EF5A93B9F0BD616B58	6.37804	72	9248FEB5FAC62F7D78BF1EF6	6.24573
9	47ADAC7406560064F8115FB2	5.96745	73	B31F8349B0E975CE2163DF5B	6.37011
10	621857F8E8584DF70B515B43	6.17527	74	5B5A23067188310302EC1DD8	5.89589
11	E7AFF39649B4BF40EA14AB82	5.96803	75	68DB010340E28CC8C03EDA8D	6.07042
12	63DF6E25075CF4AEC8BB7B37	6.20867	76	3D46C4FC0FA44A10A0F9AB50	6.44509
13	7926E816FFBE247BFB3523D8	5.84296	77	DEB60E06CF9B1A6B74E716C6	5.97516
14	AB6EF671538CED063D8D0409	6.12167	78	7998EF625BB13AA11F2E7CB5	6.48575
15	067C14A9AB654DCEDE98A865	6.1127	79	515E1AC51D4E4ED1EFE29833	5.67265
16	1303E594C4B70BA74F044900	6.03979	80	4C04969947DA02C1FE633F8E	6.09065
17	15039BDBA08FAE8F1029247B	6.20125	81	7998A7465F2132457AB8955C	5.9571
18	30212ECE434414F613077AA6	6.16053	82	C19D986D032DB17FE31CD9AE	6.11733
19	C02ED2DDB88FFEE6AB5337FE	6.02213	83	55122FEC7EC2F6A983DACE2F	6.10383
20	41DD40EB424DC2AD6BE05CF3	5.98464	84	671972100E23FC1C2796884D	5.84285
21	4342214C3081E2CF6E89287B	6.15659	85	BB553F62D04357FEA1ADE11A	5.95306
22	2E9609A7520EAAFD7BA0BC8A	5.97365	86	CC13B79839AC92C401858DA1	6.07147
23	38BB81327396436DFCE102BB	6.07687	87	2B93DE2AF1300F1FAF1F9751	6.04981
24	0D4A8D95714D1010B5219201	6.08646	88	8F16CAB5831F401D3BAAB50D	6.37539
25	154FC88D4A6923B3BA31D6D5	5.90776	89	3F40AABFC610C747A9F4DDC5	6.04727
26	60D3182A38229829D0702DE9	6.10261	90	5BEDB34AA1DDA2EF2EDD0481	6.0297
27	F9789A0CD65E4BB2EB7443A6	6.02325	91	54102D3D6073FF7626DFCBC1	6.31146
28	61ADAD010923C0E6894B2D7B	6.10446	92	E630EA96A202D642C2EF967D	5.80613
29	65A8BBD1AFC437C6D3C4145F	6.42242	93	A486DB042477809648FCC28C	6.04479
30	03CD3FAA0A04D7099245A65B	5.84834	94	6A7ACC2F5205733825DBDE99	6.22129
31	002AA85C8298BC0192E5544F	6.07626	95	10B48E798ACAD4AA3E3AE797	5.93029
32	F4A4F3DA98F4B30047562984	5.95313	96	3C09A801001ADFD4CF7D4D9E	6.63113
33	C118F99FCAE5718DC412F107	6.13199	97	604A7B78B8676F98C9334207	6.291
34	DA521751F85B23762F6A7504	6.30888	98	53D3D2BAC207B6C5C42676F7	6.06552
35	651EBF16F51584F1A971ED1D	5.88626	99	0A9D1F63F17334947DF42B21	6.04489
36	8BF7A3D3AADFE012FBDF0FE1	5.72985	100	7FD7D97FA71FCBA6019EEEB0	6.26544
37	26EE128397FB6F8E69E70392	5.67632	101	0216625445E183823625F640	6.17793
38	BE67761110AA0BCB745AEF97	6.09105	102	CADADFAC079D9472B6F1C029	5.85488
39	52CAC5943597BC412C6478A3	5.89786	103	A1113A754D6896527DD45687	6.14798
40	DA6407F19243A4F303114B5B	6.05399	104	0E81E99538FDF823EC486DEC	5.80826

41	AAB82F8281BACDF899E5D0D8	6.04693	105	91B429A6C280310AAFC0C21E	5.93907
42	AABBFD37272DCBAC1168184E	5.96119	106	1FD9DE37E6DFFE5E729AA055	5.91298
43	757F6F96FF3FDEC2E8FAD592	6.17933	107	8E050040BD230E8AA9D3038C	6.38312
44	1536BE3045FED596F3DC02A0	6.11286	108	53D5B27F74C75A8B54A00DFC	5.78173
45	C1AEA2142982477895F4CEFC	6.20865	109	719017F5E223C1C3892784A0	6.07714
46	4AF7E016C3BDCC26C3EC4800	6.34971	110	C1437202BCD94EBE97EF9DD2	6.38551
47	E66B11F92E058B44F8B0F300	6.21074	111	FF08F75A2A162E9891A833DD	6.28544
48	E3C3CEB0A084E3DC72AAA4FD	5.85822	112	60BFF734E28BDBE84F7EAA23	6.11139
49	8F2061FA66FADF172FE22BD8	6.29272	113	2B541A102414357896C06643	6.50841
50	0EAEE9C288AED9F4E184187F	5.93984	114	7B63011420A68DFF01E9FDC9	6.11687
51	A42AE1472E361F932DAB8033	5.88013	115	9ED14933BB684AB5D3FDE62D	6.1814
52	A155542ADC208C3EE4742C99	6.16644	116	CCD065BD17C0422875CDFB7D	6.03397
53	AA8A840077A6E198FDD827CE	5.85305	117	37C64C19988BC50A09D79120	5.72313
54	82222E6DF8EFE76A6D5582F6	6.03433	118	81CBC3CDDEE6060FF21DAAD2	5.98799
55	BE80D042A5F174FE2C3547D8	5.86104	119	C836CEA0ADE43D240EFE91B3	6.1621
56	DB1774BB3D1BD5031AC6E003	6.21079	120	ECA6EEB4B9B548D33CE24A59	6.25905
57	31502DE709C8E8D70033C18D	6.10352	121	978E9AC50F702EE7B3E7E37C	6.22352
58	A0540B1B0F0B51CFBEAD5E2F	6.07157	122	3F9E3940A8C1C1FD4E395300	5.69555
59	1541ECB66C740D347BDF8C4F	6.09198	123	26601EF6A0562FA81753DFA3	6.42779
60	61CF3D5EDB22623EE65E031C	6.22445	124	E1ED03E0A2D7FCDA6CEF5F4E	5.91695
61	AC40ED68234FE7F444BB2108	6.46086	125	9A7C7A9109D99741E165497B	6.15831
62	FA55AAE98754AD25A985E0C1	5.95659	126	E0FC939C021F2DE250ABEEF2	6.11713
63	4C919D7864A07BEA8C6AC24C	5.72737			

Table 2. $T(k), k = 2*\left\lfloor\frac{m}{18}\right\rfloor + m \bmod 2 = 0,1,2,\ldots,46$ (2-Tx, N=1024 or 4-Tx, N=2048)

(last bit should be ignored)

ID cell	sequence	papr	ID cell	sequence	papr
0	D088CE121099	5.66227	64	D80AF4BD51E9	5.8231
1	BE19AE1AF7F5	6.10532	65	2C443104EF7D	5.57905
2	D1024F61607F	5.47031	66	9FF5A30A6E98	5.54787
3	FFD16073A1D6	5.78104	67	7BDF08AB5376	5.32577
4	ECC4979DC7A8	5.43829	68	DAADCDB1C6CE	5.39698
5	0AE617602D61	5.49265	69	2FE6F8FC1BF7	5.54497
6	B300CCE9D099	5.53586	70	8F37A0139952	5.71968
7	633F54E20298	5.46205	71	B1E91A4C9677	5.79034
8	D06044066576	5.44115	72	DBE346281613	5.55909
9	A3DB1DD19254	5.73676	73	393E5EFACE8A	5.85929
10	D0C83A93D8A0	5.7145	74	110A8C0297DE	6.0833
11	E36B79645D19	5.40748	75	9DF0FF05A596	5.85995
12	42C8C4AA175A	5.64993	76	9343D83DEEE2	5.36045
13	4C1FA3317692	5.78842	77	33FEA057AC69	5.77107
14	6EB49E73C5D1	5.39798	78	37C789653FBB	5.71486
15	43E6A8F25CAC	5.62828	79	F5401FFF4C88	5.75793
16	CDCB70CC4186	5.55543	80	F9014BF47102	5.71708
17	D533DD50CE97	5.41124	81	ED42133BD829	6.00376
18	913A521BB291	5.4584	82	A0235CC28437	5.98352
19	CCAE39CC415D	5.53714	83	5E803F527C27	5.76979
20	E16D04EFA894	5.5247	84	2C7F2BFB3673	5.82109
21	99D12E2DFFF8	6.06748	85	13E34A8E8606	5.42021
22	1442BA2AF814	5.48042	86	6FB9F4579AFF	5.54023
23	E2407A5E763B	5.61823	87	638657B681A0	5.5361
24	B076D99B3F2C	6.13606	88	DA33054FE37E	5.7703
25	23A655762689	5.36221	89	D2F491685963	5.92507
26	2094E4597E61	5.59793	90	6EE5C380DEBF	5.47897
27	CE69337ADD34	5.46822	91	0E026697D513	5.68762
28	7FA8514F93E5	6.15637	92	EDF79A934954	5.75048
29	02BF66270182	5.80312	93	A69B1BD3CD53	5.42637
30	0B9C0E727EF2	5.63211	94	14CCC61D764F	5.57602
31	D74FCEE7312D	5.74029	95	9F67FD95A03A	5.93891
32	EF6012BF7DA4	5.91158	96	E867B2162C63	5.69613
33	FB854DFFF700	5.46136	97	0BCBB438A24B	5.45841
34	6299B4185993	5.67903	98	E7F8321EA537	5.39442
35	7832B5C80837	5.49923	99	F0740A56D46B	5.68359
36	A00572E8AE77	6.29049	100	5A5E1EDC29FE	5.97446
37	44E87B880DD8	5.98394	101	E5684BD878F2	5.38829
38	37F12A9540B6	5.35996	102	F95D51C5F90E	5.79922
39	4038BBE10035	5.47509	103	5483DDF2421B	5.7895
40	ED529EC26812	5.88229	104	E688604A7378	5.78703
41	8FDE34D679AF	5.62015	105	9B5D00F4EBD1	5.95961
42	B7D5F8C2B3AF	5.36393	106	9C45C14EE09A	5.36112
43	7396297FAA82	5.61594	107	5A031215381B	5.7582
44	3796C8104974	5.40364	108	2C10A0084353	5.32447
45	0B69C4DD6D08	5.55891	109	72B7553BDA03	5.53802
46	1A2472157E4C	5.52253	110	4CAD1E9CA983	5.51666
47	EF0E1AEEEFBE	5.62275	111	FC9F53AA6453	5.89292
48	D68C9F344645	5.54968	112	D7994930A0DD	5.88024
49	70721EA2E124	5.67249	113	4B2CF75577CE	5.70451
50	E647ADC74419	6.15904	114	3B64E84B7E53	5.38714
51	42EFBAF8ABB6	5.35146	115	D6E9FD5D692C	5.46964
52	65E0E4C9FE42	5.43829	116	404DB2F46758	5.61802
53	BF83A2C8E9DE	5.55059	117	364A4C8F58A3	5.18512
54	453D94DDF47B	5.54705	118	9018CD85D7F0	6.14053
55	D44FAB6000FB	5.52573	119	F55C5D185F7D	5.85524

56	7F12469717F7	5.61263	120	0304CA315DBA	5.47114
57	FBBE0D8C1C9C	5.3305	121	600662704FB6	5.55982
58	EA11560AE175	6.57779	122	3E8CED7650C6	5.28322
59	702ADC8FD746	6.04418	123	4984F931006E	5.55493
60	6520F8E24E27	5.33901	124	6D0061E6D953	5.67486
61	3FD9FDA2EE4C	5.85105	125	52C8B63941C3	5.62586
62	6045B912C727	5.34754	126	1B5F8355D2C3	5.43152
63	8E2B27B0C8C5	5.84279			

Table 3. $T(k), k = \left\lfloor \frac{m}{9} \right\rfloor = 0,1,2,\ldots,22$ (2-Tx, N=512 or 4-Tx, N=1024)

(last bit should be ignored)

ID cell	sequence	papr	ID cell	sequence	papr
0	6C1F5A	4.97361	64	E07D9A	5.21984
1	B316B7	4.97029	65	FE1944	5.19197
2	443206	4.67974	66	75B3A2	5.28233
3	AF8F12	5.14038	67	76C888	5.97299
4	FA10CB	5.63668	68	89561D	5.09544
5	D337F6	5.44914	69	49CFE0	5.50178
6	9E855B	5.59862	70	B7C7AF	5.11309
7	E4EFF3	5.39151	71	1F442F	5.55792
8	6C49D9	5.6987	72	4D3B24	6.19266
9	2FCB3A	5.3229	73	EAC05C	5.36774
10	052458	5.3982	74	A517F6	6.04943
11	62957D	5.11007	75	1A9545	5.99966
12	FDC1DC	5.30685	76	363200	5.08851
13	67189F	5.29941	77	539CB5	5.39483
14	5DCA1F	5.44929	78	2C899A	5.65198
15	7024DD	5.06986	79	5FA2CC	5.28374
16	76D133	5.1591	80	667491	5.8449
17	F3CF19	5.83553	81	14CE83	5.37736
18	6A7E1E	5.29067	82	B49CE7	5.49231
19	2B9075	5.31146	83	A2E172	5.29567
20	02C761	4.83125	84	B1C788	5.70411
21	8FD591	5.65578	85	8715B1	5.47128
22	BB719D	5.57877	86	EB8402	5.16585
23	4EB974	4.91816	87	AC531F	5.45399
24	E1B884	5.40552	88	88058C	4.95101
25	3756DE	4.97016	89	D54BED	6.27967
26	42851A	5.32551	90	F8D63C	4.92832
27	D022CD	5.38031	91	D30F5E	4.80216
28	5ADDCE	5.05668	92	13F9B8	5.37395
29	0F944B	5.46526	93	DA18D8	5.83116
30	E03D44	5.81444	94	072DF2	5.18797
31	B9E0E4	4.98952	95	1752E6	5.02768
32	D3782C	5.07308	96	BA8E30	5.08611
33	75BC4D	5.9198	97	414BFA	5.3167
34	60A970	5.81432	98	CDE9CE	5.63462
35	30A0C2	5.29301	99	925F98	5.07194
36	F88F27	5.50843	100	BFEA1E	5.70311
37	5915BB	5.17475	101	1076DC	4.8761
38	A6EE88	5.2782	102	F02961	5.24128
39	6EB975	5.36275	103	2224C9	5.16792
40	26B963	5.20685	104	F9FB48	5.58781
41	7C0C6F	5.12994	105	BDCCEE	5.37363
42	2C37EB	5.1122	106	48964B	5.58708
43	1FC2E0	5.29307	107	2F6C88	4.70346
44	8E6FB9	5.4982	108	BDE369	5.64959
45	194106	4.82756	109	F5ABC2	5.64354
46	0FD1D3	5.2403	110	267447	5.03984
47	FEBAFD	5.00465	111	EF672C	5.12635
48	61E56C	5.44707	112	9DC081	5.55262
49	9D6EC7	4.43605	113	A16516	5.78524
50	3E9118	5.96044	114	6A6CC0	5.3661
51	06ECCD	5.84277	115	301C98	5.58171
52	4CB57D	5.24288	116	8C5A9E	5.23938
53	887890	5.51219	117	273AC8	5.34106
54	0261AE	4.62132	118	F81BD4	6.00612
55	B0DAF9	5.90663	119	7678B6	5.61274

56	9BEB6E	5.13806	120	B0208F	5.23219
57	CE00A7	5.47452	121	8AA9DA	4.83732
58	FC1F8F	5.69578	122	F12C04	5.75277
59	8287E5	4.88742	123	24249B	5.81025
60	98DAE2	6.00215	124	DBE7B7	5.48953
61	97CF0A	5.24536	125	B5AAB1	5.55768
62	FF593F	5.21786	126	1D52D2	6.17998
63	DFD12C	4.54028			

Table 4. $T(k), k = \left\lfloor \frac{m}{9} \right\rfloor = 0,1,2,\ldots,10$ (4-Tx, N=512)

ID cell	sequence	papr	ID cell	sequence	papr
0	0 0 0 0 1 0 0 1 0 0 1	6.69904	64	0 0 0 0 0 0 1 0 0 0 0	6.57667
1	0 0 0 0 0 1 0 0 1 0 0	5.60095	65	1 0 0 0 0 1 0 0 0 0 0	8.46754
2	0 0 0 0 1 0 0 0 0 0 0	6.57667	66	0 0 0 1 1 1 1 1 0 1 0	5.72988
3	0 0 0 0 1 0 0 1 0 0 0	5.19319	67	0 0 0 0 1 1 0 0 1 1 0	6.32519
4	0 0 0 0 0 0 0 0 0 0 0	7.78151	68	0 0 1 0 0 1 0 1 0 1 1	4.94748
5	1 0 0 0 0 0 1 0 0 0 0	7.04585	69	0 0 0 0 0 0 0 0 1 0 0	6.57667
6	1 1 0 1 1 0 1 0 1 1 0	6.43304	70	0 0 0 1 1 1 0 0 0 0 1	5.71682
7	0 0 1 0 0 0 1 1 1 1 0	5.37473	71	0 1 0 1 1 0 0 1 0 1 1	5.79412
8	0 0 1 0 0 1 1 0 0 1 1	5.65899	72	1 0 1 0 1 0 1 1 0 1 0	6.18089
9	0 0 0 0 0 0 0 0 1 0 0	6.57667	73	0 1 0 1 1 1 1 0 1 0 0	6.61646
10	0 1 1 0 1 0 0 1 0 1 0	7.60573	74	1 1 0 1 0 0 1 0 1 1 0	7.45356
11	0 0 1 1 0 0 1 0 0 0 1	6.07528	75	0 0 1 0 1 0 0 1 0 0 1	5.79872
12	0 0 0 0 0 0 1 0 1 0 0	5.56169	76	0 1 1 1 1 0 0 0 0 1 1	6.64111
13	0 0 0 0 1 1 0 0 0 0 1	5.86234	77	0 0 1 1 0 0 1 0 0 1 0	4.74917
14	1 0 1 0 1 1 1 1 0 0 1	5.58147	78	1 0 0 0 0 1 0 1 1 0 1	5.61297
15	0 1 1 1 1 0 1 1 1 0 1	5.99659	79	0 0 0 0 0 1 0 0 0 1 0	6.93619
16	1 0 0 1 1 0 0 1 0 1 1	6.32679	80	0 0 0 0 1 0 0 1 0 1 1	6.19627
17	0 1 0 0 1 0 0 1 0 1 1	5.91462	81	0 1 1 1 0 1 0 1 1 1 1	5.85027
18	1 0 0 0 1 0 0 1 1 0 1	4.96849	82	0 0 1 1 1 1 1 0 0 0 1	6.4576
19	1 0 0 0 0 1 0 0 0 0 0	7.06589	83	0 1 1 1 1 0 0 0 0 0 1	6.56227
20	0 0 0 0 1 1 0 0 0 0 1	5.73888	84	0 1 1 0 1 0 1 1 1 0 1	5.63701
21	0 0 0 0 0 1 1 0 0 0 0	8.20304	85	0 0 1 1 1 1 0 0 0 0 1	7.28764
22	0 1 1 1 1 0 0 1 0 1 1	6.81171	86	1 0 1 0 0 1 0 0 1 1 1	6.45794
23	0 1 0 1 0 1 1 0 0 0 0	6.04786	87	0 0 0 0 0 0 1 0 0 0 1	6.27608
24	0 0 0 0 0 0 0 0 0 0 0	6.70403	88	0 0 0 1 1 0 0 0 0 1 1	6.39103
25	0 1 0 0 0 0 1 0 0 0 0	5.19319	89	0 0 0 0 1 1 0 0 0 0 0	7.03401
26	1 0 0 1 1 1 0 0 0 1 1	5.70508	90	0 1 1 1 1 1 1 1 1 0 1	6.84897
27	1 1 1 0 0 0 0 0 0 0 1	5.99301	91	1 1 1 1 1 1 0 0 0 0 0	7.90927
28	1 1 1 0 0 1 1 1 0 1 0	6.23728	92	0 1 0 1 0 0 1 0 0 1 0	5.24894
29	1 0 1 1 1 0 0 1 0 1 0	6.05366	93	1 1 0 1 0 0 1 0 1 0 1	7.58764
30	0 1 1 1 0 1 0 1 1 1 0	5.98197	94	0 1 1 1 0 0 1 0 0 0 1	5.63541
31	1 0 1 0 0 0 1 0 0 1 1	5.03246	95	0 1 1 1 1 0 0 1 1 0 1	5.50983
32	0 1 0 1 1 1 1 1 1 0 0	7.1076	96	1 0 0 1 0 1 1 1 0 1 0	7.06557
33	0 0 0 1 0 1 0 0 0 1 0	5.90476	97	1 1 0 0 1 1 1 0 0 0 1	5.23289
34	0 0 0 0 0 0 0 0 0 0 0	6.34336	98	0 0 1 0 1 1 0 0 0 0 0	5.48283
35	0 1 0 0 1 0 0 0 0 0 0	5.54357	99	1 1 1 0 0 1 1 0 0 0 1	5.84074
36	1 0 0 1 1 1 1 1 0 0 1	6.04447	100	1 1 0 1 1 1 1 0 0 1 1	5.92681
37	1 0 1 0 0 1 1 1 0 1 1	5.85827	101	0 1 1 0 1 1 0 1 1 0 0	6.9433
38	0 0 0 1 0 0 0 0 0 0 0	5.43569	102	1 1 0 1 1 1 0 1 1 1 0	6.08103
39	0 0 0 0 0 0 0 0 0 0 0	6.19789	103	1 0 1 0 0 0 0 0 0 0 0	5.57448
40	0 0 1 1 1 0 1 1 0 0 0	7.3564	104	0 1 0 0 1 0 1 0 0 1 0	6.53345
41	0 1 1 0 0 1 0 1 1 0 0	5.30735	105	1 0 1 0 1 0 0 0 0 1 0	7.08354
42	0 1 1 1 0 0 1 0 1 0 0	5.12931	106	0 0 1 1 0 1 0 1 0 1 1	6.40913
43	0 1 0 1 0 1 1 0 1 1 0	6.5207	107	1 1 0 0 1 0 1 0 0 1 0	6.20059
44	1 1 1 0 1 1 1 0 0 0 1	6.18911	108	0 1 0 0 1 0 0 0 0 0 1	4.99009
45	1 0 1 1 0 1 1 1 0 1 0	6.07912	109	0 0 1 0 0 0 0 1 1 1 0	6.11941
46	0 1 0 0 0 1 1 0 0 1 0	5.53222	110	0 0 0 0 0 0 0 0 0 0 0	4.94881
47	0 0 0 0 0 1 0 0 0 1 1	7.41328	111	0 1 1 1 1 0 0 1 1 0 1	6.03451
48	1 0 0 0 1 0 0 0 0 1 0	5.1473	112	0 0 1 1 0 1 1 0 1 1 0	6.75509
49	0 0 0 1 1 1 1 0 0 1 1	5.40813	113	1 1 1 0 0 1 0 0 1 1 1	5.94006
50	1 0 0 1 0 0 0 1 0 0 1	6.27513	114	1 1 1 0 1 1 1 1 0 1 1	6.23249
51	0 0 0 0 1 0 0 0 0 1 0	5.19319	115	1 0 1 0 1 1 0 0 1 1 1	6.30366
52	0 1 0 1 1 0 1 0 0 0 1	5.05186	116	0 0 1 1 0 0 0 0 0 0 0	6.31294
53	0 0 0 0 1 1 0 1 0 0 1	6.14901	117	0 1 1 1 0 1 1 0 0 0 0	5.6406
54	0 0 1 1 0 0 0 0 1 0 0	6.14504	118	0 1 1 0 1 1 1 0 0 1 1	4.8845
55	1 0 1 1 0 0 0 1 0 1 1	5.52188	119	0 0 1 1 0 0 1 1 1 0 0	6.21549
56	0 0 0 0 1 1 0 1 0 1 0	4.58312	120	1 0 0 0 0 0 1 1 1 1 1	6.25313

57	0 1 1 1 1 1 0 1 0 1 0	7.00465	121	1 0 0 0 0 0 1 0 0 0 0	5.63634
58	0 1 0 0 0 1 0 0 0 0 0	7.28642	122	0 1 1 1 0 1 1 0 0 0 1	4.72645
59	1 1 1 1 1 0 1 1 1 0 1	6.06949	123	1 1 0 1 0 1 1 1 0 1 0	7.65545
60	1 0 0 1 1 0 1 1 0 0 1	6.4239	124	1 0 1 1 0 1 0 0 1 0 0	7.27665
61	1 1 0 0 0 0 0 0 0 0 0	6.29118	125	0 0 0 0 0 0 1 1 0 1 1	7.59826
62	0 1 0 1 0 1 0 1 0 1 0	6.00713	126	1 0 1 0 1 1 0 1 1 0 1	6.32406
63	1 1 0 0 1 1 0 0 0 0 0	6.0206			