IEEE P802.11
Wireless LANs

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| PDT - Constellation mapping |
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Abstract

This document contains proposed draft text for Constellation mapping.

* R1: removed figures, added “DUP mode”

# Introduction

This document contains a text proposal for section 34.3.12.9 (Constellation mapping).

The proposed text is in accordance with the following Motions:

* Motion 111, #SP0611-21 (802.11be shall define 4096 QAM as one of the optionally supported modulations)
* Motion 111, #SP0611-22 (The uniform constellation mapping for 4096 QAM shall be as given in 11-20/0111r0)
* Motion 112, #SP147 (DCM+MCS0 for Nss=1 as defined in 802.11ax is a MCS in 802.11be.)

# Proposed text

#### Constellation mapping

The mapping between the input bits of the constellation mapper and complex constellation points for BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM and 1024-QAM is defined in 27.3.12.9 (Constellation mapping).

For 4096-QAM, each constellation point encodes 12 bits (B0 – B11). B0B1B2B3B4B5 determines the I value and B6B7B8B9B10B11 determines the Q value, as illustrated in Table 1.

**Table 1 – 4096-QAM encoding table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input Bits (B0 B1 B2 B3 B4 B5)** | **I-out** |  | **Input Bits (B6 B7 B8 B9 B10 B11)** | **Q-out** |
| 000000 | -63 |  | 000000 | -63 |
| 000001 | -61 |  | 000001 | -61 |
| 000011 | -59 |  | 000011 | -59 |
| 000010 | -57 |  | 000010 | -57 |
| 000110 | -55 |  | 000110 | -55 |
| 000111 | -53 |  | 000111 | -53 |
| 000101 | -51 |  | 000101 | -51 |
| 000100 | -49 |  | 000100 | -49 |
| 001100 | -47 |  | 001100 | -47 |
| 001101 | -45 |  | 001101 | -45 |
| 001111 | -43 |  | 001111 | -43 |
| 001110 | -41 |  | 001110 | -41 |
| 001010 | -39 |  | 001010 | -39 |
| 001011 | -37 |  | 001011 | -37 |
| 001001 | -35 |  | 001001 | -35 |
| 001000 | -33 |  | 001000 | -33 |
| 011000 | -31 |  | 011000 | -31 |
| 011001 | -29 |  | 011001 | -29 |
| 011011 | -27 |  | 011011 | -27 |
| 011010 | -25 |  | 011010 | -25 |
| 011110 | -23 |  | 011110 | -23 |
| 011111 | -21 |  | 011111 | -21 |
| 011101 | -19 |  | 011101 | -19 |
| 011100 | -17 |  | 011100 | -17 |
| 010100 | -15 |  | 010100 | -15 |
| 010101 | -13 |  | 010101 | -13 |
| 010111 | -11 |  | 010111 | -11 |
| 010110 | -9 |  | 010110 | -9 |
| 010010 | -7 |  | 010010 | -7 |
| 010011 | -5 |  | 010011 | -5 |
| 010001 | -3 |  | 010001 | -3 |
| 010000 | -1 |  | 010000 | -1 |
| 110000 | 1 |  | 110000 | 1 |
| 110001 | 3 |  | 110001 | 3 |
| 110011 | 5 |  | 110011 | 5 |
| 110010 | 7 |  | 110010 | 7 |
| 110110 | 9 |  | 110110 | 9 |
| 110111 | 11 |  | 110111 | 11 |
| 110101 | 13 |  | 110101 | 13 |
| 110100 | 15 |  | 110100 | 15 |
| 111100 | 17 |  | 111100 | 17 |
| 111101 | 19 |  | 111101 | 19 |
| 111111 | 21 |  | 111111 | 21 |
| 111110 | 23 |  | 111110 | 23 |
| 111010 | 25 |  | 111010 | 25 |
| 111011 | 27 |  | 111011 | 27 |
| 111001 | 29 |  | 111001 | 29 |
| 111000 | 31 |  | 111000 | 31 |
| 101000 | 33 |  | 101000 | 33 |
| 101001 | 35 |  | 101001 | 35 |
| 101011 | 37 |  | 101011 | 37 |
| 101010 | 39 |  | 101010 | 39 |
| 101110 | 41 |  | 101110 | 41 |
| 101111 | 43 |  | 101111 | 43 |
| 101101 | 45 |  | 101101 | 45 |
| 101100 | 47 |  | 101100 | 47 |
| 100100 | 49 |  | 100100 | 49 |
| 100101 | 51 |  | 100101 | 51 |
| 100111 | 53 |  | 100111 | 53 |
| 100110 | 55 |  | 100110 | 55 |
| 100010 | 57 |  | 100010 | 57 |
| 100011 | 59 |  | 100011 | 59 |
| 100001 | 61 |  | 100001 | 61 |
| 100000 | 63 |  | 100000 | 63 |

The normalization factor Kmod for 4096 QAM is ${1}/{\sqrt{2730}}$.

DCM is an optional modulation scheme. It only applies to BPSK and *NSS*=1.

If DCM is employed for a 996-tone or smaller RU, bit sequences are mapped to a pair of symbols $\left(d\_{k}^{'}, d\_{q(k)}^{'}\right)$ where $k$ is in the range of $0\leq k\leq N\_{SD}-1$ and $q(k)$ is in the range of $N\_{SD}\leq k\leq 2N\_{SD}-1$. For RUs equal to or smaller than 996 tones, $q\left(k\right)=k+N\_{SD}$.

For larger RU sizes, DCM is performed within each 80 MHz segment.

For BPSK modulation with DCM, the input stream is broken into groups of $N\_{CBPS,u}$bits $\left(B\_{0}, B\_{1}, …, B\_{N\_{CBPS,u}}\right)$. Each bit $B\_{k}$is BPSK modulated to a sample $d\_{k}^{'}$. This generates the samples for the lower half of the data subcarriers. For the upper half of the subcarriers, the samples are generated as $d\_{k+N\_{SD}}^{'}=d\_{k}^{'}e^{j\left(k+N\_{SD}\right)π}$, $k=0, 1, …, N\_{SD}-1$.

DUP mode is used in combination with MCS0 + DCM and *NSS*=1.

DUP80 mode is defined as a 484-tone RU whose content is replicated twice to occupy 80 MHz bandwidth. Within each 484-tone RU, DCM is applied as described above.

DUP160 mode is defined as a 996-tone RU whose content is replicated twice to to occupy 160 MHz bandwidth. Within each 996-tone RU, DCM is applied as described above.

DUP320 mode is defined as a 2x996-tone RU whose content is replicated twice to occupy 320 MHz bandwidth. Within each 2x996-tone RU, DCM is applied as described above.