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Wireless LANs

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| 29.5.7.27 Encoding |
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Abstract

This document proposes specification text for subclause 29.5.7.27 of the spec describing LDPC encoding process for MIMO, [1].

**29.5.7.27 Encoding**

**29.5.7.27.4 General**

An EDMG SC mode PSDU is encoded by a systematic LDPC block code as defined in 20.6.3.2.3.1. The EDMG encoding supports two types of block size equal to 624 or 672 bits (short codeword) and 1344 bits (long codeword). The set of code rates is defined in Table 33. The parity check matrices are defined in 29.5.7.27.5. The encoding process for SISO transmissions is defined in 29.5.7.27.6. The encoding process for MIMO transmissions is defined in 29.5.7.27.7.

1. —LDPC code rates

|  |  |  |
| --- | --- | --- |
| Code rate | Codeword size | Number of data bits |
| Short | Long | Short | Long |
| ½ | 672 | 1344 | 336 | 672 |
| 5/8 | 672 | 1344 | 420 | 840 |
| ¾ | 672 | 1344 | 504 | 1008 |
| 13/16 | 672 | 1344 | 546 | 1092 |
| 7/8 | 624/672 | 1344 | 588 | 1176 |

**29.5.7.27.5 Parity check matrices**

See 29.3.7.

**29.5.7.27.6 LDPC encoding for SISO transmission**

This subclause defines a SC PHY PSDU encoding process for SISO transmission. The EDMG encoding process includes the following steps.

First, employ steps a) – c) as defined in subclause 20.6.3.2.3.3 for DMG encoding, assuming that *LCW* can be equal to 624, 672, or 1344 bits and *LCW* = 672, *R* = 7/8 code shall use the b.1) encoding procedure.

In case of BRP packet the minimum number of codewords *NCWmin* is proportional to the *NCB* and defined in Table 2.

1. Zero filling for EDMG SC mode BRP packets

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| EDMG-MCS index | Modulation | NCBPS | Repetition | Code Rate | Data rate (Mbps)  | NCWmin |
| Normal GI | Short GI | Long GI |
| 1 | π/2-BPSK | 1 | 2 | 1/2  | NCB×NSS×385.00 | NCB×NSS×412.50 | NCB×NSS×330.00 | NCBx12 |
| 2 | π/2-BPSK | 1 | 1 | 1/2  | NCB×NSS×770.00 | NCB×NSS×825.00 | NCB×NSS×660.00 | NCBx12 |
| 3 | π/2-BPSK | 1 | 1 | 5/8  | NCB×NSS×962.50 | NCB×NSS×1031.25 | NCB×NSS×825.00 | NCBx12 |
| 4 | π/2-BPSK | 1 | 1 | 3/4  | NCB×NSS×1155.00 | NCB×NSS×1237.50 | NCB×NSS×990.00 | NCBx12 |
| 5 | π/2-BPSK | 1 | 1 | 13/16 | NCB×NSS×1251.25 | NCB×NSS×1340.63 | NCB×NSS×1072.50 | NCBx12 |
| 6 | π/2-BPSK | 1 | 1 | 7/8  | NCB×NSS×1347.50 | NCB×NSS×1443.75 | NCB×NSS×1155.00 | NCBx12 |
| 7 | π/2-QPSK | 2 | 1 | 1/2  | NCB×NSS×1540.00 | NCB×NSS×1650.00 | NCB×NSS×1320.00 | NCBx23 |
| 8 | π/2-QPSK | 2 | 1 | 5/8  | NCB×NSS×1925.00 | NCB×NSS×2062.50 | NCB×NSS×1650.00 | NCBx23 |
| 9 | π/2-QPSK | 2 | 1 | 3/4  | NCB×NSS×2310.00 | NCB×NSS×2475.00 | NCB×NSS×1980.00 | NCBx23 |
| 10 | π/2-QPSK | 2 | 1 | 13/16 | NCB×NSS×2502.50 | NCB×NSS×2681.25 | NCB×NSS×2145.00 | NCBx23 |
| 11 | π/2-QPSK | 2 | 1 | 7/8  | NCB×NSS×2695.00 | NCB×NSS×2887.50 | NCB×NSS×2310.00 | NCBx23 |
| 12 | π/2-16QAM | 4 | 1 | 1/2  | NCB×NSS×3080.00 | NCB×NSS×3300.00 | NCB×NSS×2640.00 | NCBx46 |
| 13 | π/2-16QAM | 4 | 1 | 5/8  | NCB×NSS×3850.00 | NCB×NSS×4125.00 | NCB×NSS×3300.00 | NCBx46 |
| 14 | π/2-16QAM | 4 | 1 | 3/4  | NCB×NSS×4620.00 | NCB×NSS×4950.00 | NCB×NSS×3960.00 | NCBx46 |
| 15 | π/2-16QAM | 4 | 1 | 13/16 | NCB×NSS×5005.00 | NCB×NSS×5362.50 | NCB×NSS×4290.00 | NCBx46 |
| 16 | π/2-16QAM | 4 | 1 | 7/8  | NCB×NSS×5390.00 | NCB×NSS×5775.00 | NCB×NSS×4620.00 | NCBx46 |
| 17 | π/2-64QAM | 6 | 1 | 5/8  | NCB×NSS×5775.00 | NCB×NSS×6187.50 | NCB×NSS×4950.00 | NCBx69 |
| 18 | π/2-64QAM | 6 | 1 | 3/4  | NCB×NSS×6930.00 | NCB×NSS×7425.00 | NCB×NSS×5940.00 | NCBx69 |
| 19 | π/2-64QAM | 6 | 1 | 13/16 | NCB×NSS×7507.50 | NCB×NSS×8043.75 | NCB×NSS×6435.00 | NCBx69 |
| 20 | π/2-64QAM | 6 | 1 | 7/8  | NCB×NSS×8085.00 | NCB×NSS×8662.50 | NCB×NSS×6930.00 | NCBx69 |

***Note to editor: Table 2 need to be moved to the subclause “EDMG-BRP packet duration”.***

The number of SC symbol blocks, *NBLKS*, and the number of symbol block padding bits, *NBLK\_PAD*, are calculated as follows:





where:

*NCBPB* is the number of coded bits per block transmitted over the 2.16 GHz channel

*NCB* defines the number of 2.16 GHz channels, *NCB* (1 ≤ *NCB* ≤ 4), that make up the signal bandwidth of the EDMG PPDU

The values of *NCBPB* for different types of GI are provided inTable 1. The coded bit stream is concatenated with *NBLK\_PAD* zeros. They are scrambled using the continuation of the scrambler sequence that scrambled the PSDU input bits.

1. —Values of NCBPB for different types of GI

|  |  |  |  |
| --- | --- | --- | --- |
| Symbol mapping | Short GI | Normal GI | Long GI |
| π/2-BPSK | 480 | 448 | 384 |
| π/2-QPSK | 960 | 896 | 768 |
| π/2-16QAM | 1920 | 1792 | 1536 |
| π/2-64QAM | 2880 | 2688 | 2304 |

**29.5.7.27.7 LDPC encoding for MIMO transmission**

This subclause defines a SC PHY PSDU encoding process for MIMO transmission. The EDMG encoding process includes the following steps.

1. First the number of data pad bits *NDATA\_PAD* and the number of LDPC codewords per *i*-th spatial stream *NCW i* are calculated as follows:







If BRP packet and *NCW* < NCB x 12, then *NCW* = NCB x 12

where

* *LCW* is the LDPC codeword length, assuming that *LCW* can be equal to 672 or 1344
* *Length* is the length of the PSDU defined in the header field (in octets)
* ρi is the repetition factor for *i*-th spatial stream
* *Ri* is the code rate for *i*-th spatial stream
* *NCBPS i* is the number of coded bits per symbol for *i*-th spatial stream (constellation point)
* *NSS* is the total number of spatial streams

The scrambled PSDU is concatenated with *NDATA\_PAD* zeros. They are scrambled using the continuation of the scrambler sequence that scrambled the PSDU input bits.

1. Bits distribution over the spatial streams is performed on the group basis with the number of bits in the group for *i*-th stream equal to (*NCBPS i* x *Ri* x 16) / ρi. The distribution is performed in the round robin manner. It means that the first group of bits comes to the first stream, the second group of bits comes to the second stream and etc. The procedure is repeated when the maximum number of streams *NSS* is reached.
2. The procedure for converting the scrambled PSDU data to LDPC codewords depends on the repetition factor and defined in subclause 20.6.3.2.3.3 at steps b) and c). The code *LCW* = 672 and *R* = 7/8 shall use b.1) encoding procedure.
3. The number of symbol blocks, NBLKS, and the number of symbol block padding bits per *i*-th spatial stream, NBLK\_PAD i, are calculated:



where *NSPB* is the number of symbols (constellation points) per block transmitted over a 2.16 GHz channel, the values of *NSPB* for different types of GI are defined in Table 2

1. The coded bits for *i*-th spatial stream are concatenated with *NBLK PAD i* zeros. They are scrambled using the continuation of the scrambler sequence that scrambled the PSDU input bits. First, the pad bits of the first spatial stream are scrambled, second, the pad bits of the second spatial stream are scrambled, and etc.
2. Values of NSPB for different types of GI

|  |  |  |
| --- | --- | --- |
| Short GI | Normal GI | Long GI |
| 480 | 448 | 384 |

**References:**

1. Draft P802.11ay\_D0.1