IEEE P802.11  
Wireless LANs

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| CID Resolution – Part V, Clause 30.5 | | | | |
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|  |  |  |  |  |

Abstract

This document proposes resolution for CIDs 1511, 1512, 1929, 1513, 1930, 1932, 2177, 1931, 1514, 1933, 1515, 1414, 1614, 1615, 1270, 1271, 1812, 1813, 1814, 1822, 1312, 1616, 1618, 2032, 1549, 1619, 1916, 1928, 1399, 1668, 1517, 1518, 1519, 1516, (34) [1].

**CID 1511**

*Comment:*

"The SC block size is 1024 bits for 4.32 GHz PPDU transmissions," A SC block consists of symbols, not bits.

*Proposed change:*

change "bits" to "symbols"

*Resolution:*

Revised.

*Editor: change the text as below, page 280, line 18, [2]*

* 1. EDMG and non-EDMG SC mode
     1. General

Transmission and reception of SU 2.16 GHz PPDU using EDMG SC mode MCSs 1 – 5 and 7 – 10 with single spatial stream and 2.16 GHz PPDU using non-EDMG SC mode MCSs 1 – 4 and SU 4.32 GHz PPDU using EDMG SC mode MCSs 1 – 5 and 7 – 10 with single spatial stream and 4.32 GHz PPDU using non-EDMG duplicate SC mode MCSs 1 – 4 is mandatory.

Transmission and reception of SU and MU 2.16+2.16 GHz PPDU using EDMG and 2.16+2.16 GHz PPDU using non-EDMG SC mode is optional. Transmission and reception of SU and MU 4.32 GHz PPDU, 6.48 GHz PPDU, 8.64 GHz PPDU, and 4.32+4.32 GHz PPDU using EDMG SC mode and 4.32 GHz PPDU, 6.48 GHz PPDU, 8.64 GHz PPDU, and 4.32+4.32 GHz PPDU using non-EDMG duplicate SC mode is optional.

* + 1. Signal parameters
       1. General

This subclause defines the main EDMG SC signal parameters for 2.16 GHz (*NCB* = 1), 4.32 GHz (*NCB* = 2), 6.48 GHz (*NCB* = 3), 8.64 GHz (*NCB* = 4), 2.16+2.16 GHz (*NCB* = 1), and 4.32+4.32 GHz PPDU (*NCB* = 2) transmissions.

* + - 1. Timing related parameters

Table 56 provides a summary of the EDMG SC mode timing related parameters.

Table 56—EDMG SC mode timing related parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Value | | | |
| *NCB* = 1 | *NCB* = 2 | *NCB* = 3 | *NCB* = 4 |
| *NSPB*: Number of symbols per SC symbol block for short GI length | 480 | 960 | 1440 | 1920 |
| *NSPB*: Number of symbols per SC symbol block for normal GI length | 448 | 896 | 1344 | 1792 |
| *NSPB*: Number of symbols per SC symbol block for long GI length | 384 | 768 | 1152 | 1536 |
| *NGI short*: short guard interval length | 32 | 64 | 96 | 128 |
| *NGI normal*: normal guard interval length | 64 | 128 | 192 | 256 |
| *NGI long*: long guard interval length | 128 | 256 | 384 | 512 |
| *Fc EDMG*: EDMG SC chip rate | 1.76 GHz | 3.52 GHz | 5.28 GHz | 7.04 GHz |
| *Tc EDMG*: EDMG SC chip time | 0.57 ns | 0.28 ns | 0.19 ns | 0.14 ns |
| *NDFT:* DFT size | 512 | 1024 | 1536 | 2048 |
| *TDFT*: SC IDFT/DFT period | 0.291 µs | 0.291 µs | 0.291 µs | 0.291 µs |
| *TGI short*: short guard interval duration | 18.18 ns | 18.18 ns | 18.18 ns | 18.18 ns |
| *TGI normal*: normal guard interval duration | 36.36 ns | 36.36 ns | 36.36 ns | 36.36 ns |
| *TGI long*: long guard interval duration | 72.72 ns | 72.72 ns | 72.72 ns | 72.72 ns |

NOTE – The non-EDMG and pre-EDMG modulated fields are defined at the SC chip rate *Fc* = 1.76 GHz and the corresponding chip time duration *Tc* = 0.57 ns. The EDMG modulated fields are defined at the EDMG SC chip rate *Fc EDMG* = *Fc*×*NCB* GHz and the corresponding chip time duration *Tc EDMG* = *Tc*/*NCB* ns.

*Editor: change the text as below, page 301, Table 67, [2]*

|  |  |
| --- | --- |
|  | Number of symbols (constellation points) per SC symbol block; depends on the GI type as defined in Table 56. |

*Editor: change the text as below, page 302, line 4, [2]*

Table 56 defines the number of symbols (constellation points) per SC symbol block, NSPB, for different types of GI.



*Editor: change the text as below, page 306, line 12, [2]*



*Editor: change the text as below, page 306, line 16, [2]*



*Editor: change the text as below, page 309, line 1, [2]*

The DCM π/2-SQPSK modulation uses the same symbol blocking structure as for a SU PPDU defined in 30.5.9.2.2.3.

* + - * 1. Space-time block coding (STBC)

The STBC performs a single spatial stream to two space-time streams mapping and includes the following steps:

* The input encoded bits stream of a single spatial stream are broken into groups of NCBPB × NCB bits, , where *q* denotes the group number. The STBC applies the encoding procedure defined in 30.5.9.4.3. The padding procedure requires that the total number of groups of NCBPB × NCB bits shall be an even number.
* Each group of bits , *k* = 0, 1, …, *NSPB* – 1, is converted to the constellation point  following the rules defined in 20.6.3.2.4.
* STBC operates with symbol blocks, *q* = 0, 1, …, *NBLKS* – 1, and with blocks with inverted symbols order  of a single spatial stream and assigns these blocks to two space-time streams.
* The modulated data symbols for the first space-time stream are defined as 
* The modulated data symbols for the second space-time stream are defined as 
* STBC uses the same symbol blocking structure for a SU PPDU and an MU PPDU defined in 30.5.9.2.2.3 and 30.5.9.2.4, respectively.
  + - * 1. Block interleaver

The block interleaver is defined for π/2-64-QAM and π/2-64-NUC modulations. The block interleaver performs modulated complex symbols interleaving inside a SC symbol block and its parameters depend on the *NSPB*, *NCB*, , , and  parameters.

The input to the interleaver for the ith spatial stream is a SC symbol block  of length *NSPB* and composed of π/2-64-QAM or π/2-64-NUC symbols , where *q* denotes the SC symbol block number, *q* = 0, 1, …, .

The output of the interleaver for the ith spatial stream is a permuted SC symbol block  of the same length defined as , where *idx* defines the array of permutation indexes.

The array of permutation indexes *idx* is constructed as follows:

* , where *i* = 0, 1, …, Nx – 1 and *j* = 0, 1, …, Ny – 1.
* 
* 
* 

**CID 1512**

*Comment:*

Wrong references for each "see 30.5.x.y"

*Proposed change:*

"Modify as follows:

Scrambler; see 30.5.9.3

LDPC encoder; see 30.5.9.4

;

Cyclic shift (CSD) insertion; 30.5.3.2 and 30.5.3.3.1"

*Resolution:*

Accepted.

*Editor: change the text as below, page 281, line 7, [2]*

* + - 1. General

EDMG and non-EDMG SC PPDU transmissions can be generated using a transmitter consisting of the following blocks:

* Scrambler scrambles the data to reduce the probability of long sequences of 0s and 1s; see 30.5.9.3 .
* LDPC encoder encodes the data to enable error correction. It pads the data with zeros to get an integer number of codewords and SC symbol blocks; see30.5.9.4.
* Stream parser divides the output of the LDPC encoder into the groups of bits that are sent to different mapping devices. The sequence of the bits sent to different mapping devices is called a spatial stream; see 30.5.9.4.
* Constellation mapper maps the sequence of bits in each stream to constellation points (complex numbers); see 30.5.9.5.
* Interleaver performs interleaving inside a SC symbol block; see 30.5.9.5.4.
* STBC encoder spreads constellation points from NSS spatial streams into NSTS space-time streams using a space-time block code. SC mode defines single STBC scheme with NSS = 1 and NSTS = 2; see 30.5.9.5.3.
* GI insertion prepends the SC symbol block with guard interval defined as a π/2-BPSK modulated Golay sequence; see 30.5.9.2.
* Preamble builder builds π/2-BPSK modulated Ga and Gb Golay sequences comprising the L-STF, L-CEF, EDMG-STF, and EDMG-CEF fields; see 30.10.
* Spatial mapper maps space-time streams to transmit chains. This may include one of the following, see 30.5.10.2:
* Direct mapping: constellation points from each space-time stream are mapped directly into the transmit chains.
* Indirect mapping: constellation points from each space-time stream are mapped to each transmit chain.
* Digital beamforming: each vector of constellation points from all of the space-time streams is multiplied by a matrix of steering vectors to produce the input to the transmit chains.
* Cyclic shift diversity (CSD) prevents the signal transmission from unintentional beamforming. A cyclic shift is specified per transmitter chain for non-EDMG duplicate PPDU transmission; see 30.5.3.2 and 30.5.3.3.1.
* Pulse shaping performs convolution of constellation points with shape filter impulse response with possible sampling rate change. For duplicate channel transmission, pulse shaping may include a relative time delay between the primary and secondary channels. The exact definition of shape filter impulse response is out of scope of this standard and is implementation specific.

**CID 1929**

*Comment:*

stream should be "spatial stream"

*Proposed change:*

Change "each stream" to "each spatial stream"

*Resolution:*

Accepted.

*Editor: change the text as below, page 281, line 14, [2]*

* Constellation mapper maps the sequence of bits in each spatial stream to constellation points (complex numbers); see 30.5.9.5.

*Editor: change the text as below, page 336, line 18, [2]*

1. Constellation mapper maps the sequence of bits in each spatial stream to constellation points (complex numbers); see 30.6.8.3.

**CID 1513**

*Comment:*

"The title of this subclause should be ""30.5.3.3.1 Pre-EDMG modulated fields transmission"" instead of ""Pre-EDMG fields of PPDU transmission,"" according to the terminology in Figure 117.

Similarly, the following subclauses should be ""30.5.3.3.2 EDMG modulated fields of SU PPDU transmission"" ""30.5.3.3.3 EDMG modulated fields of MU PPDU transmission"" respectively."

*Proposed change:*

As per comment

*Resolution:*

Revised.

*Editor: change the text as below, page 282, line 20, [2]*

* + - * 1. Pre-EDMG modulated fields of PPDU transmission

*Editor: change the text as below, page 283, line 1, [2]*

* + - * 1. EDMG modulated fields of SU PPDU transmission

Figure 129 shows the transmitter blocks used to generate the EDMG modulated fields of SU PPDU.

*Editor: change the text as below, page 283, line 11, [2]*

Figure129—Transmitter block diagram for EDMG modulated fields of SU PPDU transmission

*Editor: change the text as below, page 283, line 14, [2]*

30.5.3.3.3 EDMG modulated fields of MU PPDU transmission

Figure 130 shows the transmitter blocks used to generate the EDMG modulated fields of an MU PPDU.

*Editor: change the text as below, page 284, line 6, [2]*

Figure 130—Transmitter block diagram for EDMG modulated fields of an MU PPDU transmission

*Editor: change the text as below, page 337, line 20, [2]*

* + - 1. EDMG PPDU transmission

30.6.2.2.1 Pre-EDMG modulated fields of PPDU transmission

See 30.5.3.3.1.

* + - * 1. EDMG modulated fields of SU PPDU transmission

Figure 147 shows the transmitter blocks used to generate the EDMG modulated fields of an SU PPDU. The EDMG-STF and EDMG-CEF fields are generated using the preamble builder, IDFT, and GI insertion blocks. The TRN field is generated using the TRN builder, IDFT, and GI insertion blocks. The Data field is generated using the scrambler, the LDPC encoder, the constellation mapper, the interleaver, IDFT, and GI insertion blocks. If the STBC encoder is applied, then a single spatial stream is mapped to two space-time streams as defined in 30.6.8.3.10. The NSTS space-time streams are further mapped to NTX transmit chains, where NSTS ≤ NTX.

*Editor: change the text as below, page 338, line 3, [2]*

Figure 147 — Transmitter block diagram for EDMG modulated fields of SU PPDU transmission

* + - * 1. EDMG modulated fields of MU PPDU transmission

Figure 148 shows the transmitter blocks used to generate the EDMG modulated fields of an MU PPDU. The EDMG-STF and EDMG-CEF fields are generated using the preamble builder, IDFT, and GI insertion blocks. The TRN field is generated using the TRN builder, IDFT, and GI insertion blocks. The EDMG-Header-B and Data fields are generated using the scrambler, the LDPC encoder, the constellation mapper, the interleaver, IDFT, and GI insertion blocks. The PPDU encoding uses the seed value defined in the EDMG-Header-B and has an independent flow per user. However, the transmitter keeps a common space-time stream enumeration over all users. If the STBC encoder is applied, then a single spatial stream is mapped to two space-time streams as defined in 30.6.8.3.10. The NSTS space-time streams are further mapped to NTX transmit chains, where NSTS ≤ NTX.

*Editor: change the text as below, page 339, line 3, [2]*

Figure 148 — Transmitter block diagram for EDMG modulated fields of MU PPDU transmission

**CID 1930, 1932, 2177**

*Comment:*

It is not clear what this sentence means: "However, transmitter keeps the common space-time streams numeration over all users."

Figure 130 shows that, for each user, Nss and N\_STS <=2. But there is no description in the test.

No reference to EDMG-Header-B in text

*Proposed change:*

Explain or rephrase this sentence: "However, transmitter keeps the common space-time streams numeration over all users."

Add a sentence to indicate Nss and N\_STS <=2

Change text to: "The PPDU encoding uses seed values in EDMG-Header-B as defined in 30.5.6, and......user."

*Resolution:*

Revised.

*Editor: change the text as below, page 283, line 19, [2]*

Figure 130 shows the transmitter blocks used to generate the EDMG portion of an MU PPDU. The EDMG-STF and EDMG-CEF fields are generated using the Preamble builder block. The TRN field is generated using TRN builder block. The EDMG-Header-B and Data field of the PPDU are generated using scrambler, LDPC encoder, constellation mapper, interleaver, and GI insertion blocks. The PPDU encoding uses seed value defined in EDMG-Header-B and has independent flow per user. The EDMG-Header-B encoding is defined in 30.5.6. The space-time streams mapping is defined in 30.5.9.4.4. The total number of space-time streams per user is less or equal to 2. If STBC encoder is applied, then a single spatial stream is mapped to two space-time streams as defined in 30.5.9.5.3. The NSTS space-time streams are further mapped to NTX transmit chains, where NSTS ≤ NTX.

**CID 1931**

*Comment:*

Since STBC is indicated in SIG-A, if it is used, it will apply to all users. It would be better to mention it in this paragraph.

*Proposed change:*

Add a sentence to indicate that all users will use STBC if it is set in SIG-A.

*Resolution:*

Rejected.

*Discussion:*

Other CID proposes to move the STBC indication to the EDMG-Header-B. Assuming that, there is no need in this clarification sentence.

**CID 1514**

*Comment:*

Q precoding will be applied for all of the EDMG-Pream, Data part in the later subclause (P324L9.) It is not needed to apply precoding Q in subclauses of EDMG-STF definition (P285L14) and EDMG-CEF definition (P286L17).

*Proposed change:*

Remove spatial mapping function (Q) from subclauses 30.5.4.2 (EDMG-STF definition), 30.5.5.2 (EDMG-CEF definition).

*Resolution:*

Rejected.

*Discussion:*

Legacy VHT PHY defines the STF/LTF fields per TX chain. To be consistent we also define STF/CEF waveforms per TX chain in 11ay.

**CID 1933**

*Comment:*

No need to specify the unit for "Tc = 1/Fc"

*Proposed change:*

Delete "ns" after "Tc=1/Fc"

*Resolution:*

Accepted.

*Editor: change the text as below, page 285, line 11, [2]*

The EDMG-STF field transmit waveform in time domain shall be defined at the SC chip rate Fc equal to 1.76 GHz and chip time duration Tc = 1/Fc for PPDU transmission over a 2.16 GHz channel.

**CID 1515**

*Comment:*

The carriage return in the brackets looks like a vector and is not common.

*Proposed change:*

Place each bracket on a line. see eq(17-22) on P2301 of 802.11-2016 for an example

*Resolution:*

Accepted.

*Editor: change the text as below, page 287, line 5, [2]*



**CID 1414**

*Comment:*

In Figure 128, the PPDU can be transmitted using not only CSD, but also using digital/hybrid beamforming as defined in 30.5.10.3

*Proposed change:*

Replace CSD blocks with Spatial Mapper block.

*Resolution:*

Accepted.

*Editor: change the text as below, page 282, line 14, Figure 128, [2]*



Figure 128—Transmitter block diagram for non-EDMG PPDU transmission

**CID 1614**

*Comment:*

It seems there is a inconsistency in symbol blocking with different GI lengths. Compare Figure 131 and 133 short vs. long GI: Why is the GI following header A\_2 SC block 128 in case of long GI but 64 in case of 32?

*Proposed change:*

Please correct/ unify if applicable. To me it's not clear why it should be different to Figure 134

*Resolution:*

Rejected.

*Discussion: page 295, line 1, [2]*

The choice of GIs in case of short and long GI allows smooth transition between different types of GI.

**CID 1615**

*Comment:*

It's not clear why in Figure 140 the GI embedding header A1 and A2 SC blocks are determined by the first 64 samples of GI 128.

*Proposed change:*

I think it's not necessary as there are always 2 GIs between PPDUs in A-PPDU anyway.

*Resolution:*

Rejected.

*Editor: change the text as below, page 297, line 9, Figure 140, [2]*

The choice of GIs in case of short and long GI allows smooth transition between different types of GI.

**CID 1270, 1271, 1812, 1813, 1814, 1822**

*Comment:*

change the text "168, zeros are appended" to be "168 zeros are appended"

change the text "336, zeros are appended" to be "336 zeros are appended"

Spelling mistake "discareded"

Spelling mistake "encpding"

Spelling mistake "encpding"

"LCW" must be "L\_CW" (CW must be subscript).

*Proposed change:*

as in comment

as in comment

change spelling to "discarded"

change spelling to "encoding"

change spelling to "encoding"

Change "CW" to subscript.

*Resolution:*

Accepted.

*Editor: change the text as below, page 300, line 16, [2]*

The LDPC encoding for code rate 2/3 with codeword length LCW = 504 and 1008 employs the original matrices H with LCW = 672 and 1344 for code rate R = 3/4, and then applies a shortening procedure to get to a desired code rate R = 2/3. For LCW = 504, 168 zeros are appended to 336 data bits before encoding; for LCW = 1008, 336 zeros are appended to 672 data bits before encoding. After encoding the zero bits are discarded and not transmitted.

The LDPC encoding for code rate 5/6 with codeword length LCW = 504 and 1008 employs the original matrices H with LCW = 672 and 1344 for code rate R = 7/8. For LCW = 504, 168 zeros are appended to 420 data bits before encoding; for LCW = 1008, 336 zeros are appended to 840 data bits before encoding. After encoding, the zero bits are discarded and not transmitted.

The LDPC encoding for code rate 5/6 with codeword length LCW = 468 and 936 employs the original matrices H with LCW = 672 and 1344 for code rate R = 13/16. For LCW = 468, 156 zeros are appended to 390 data bits before encoding; for LCW = 936, 312 zeros are appended to 780 data bits before encoding. After encoding, the zero bits are discarded; for LCW = 468, the first 48 parity bits are discarded (punctured); for LCW = 936, the first 96 parity bits are discarded and not transmitted.

**CID 1312**

*Comment:*

It is not clear how the selection between rate 5/6 with LCW=504 and LCW=468 is done using PHY-SERVICE and EDMG-A header fields. I guess it is related to the super-imposed codes field, but it is only a guess

*Proposed change:*

Add reference to this code in the super-imposed field in the PHY-Service interface and EMDG-A header fields

*Resolution:*

Revised.

*Editor: change the text as below, page 291, line 3, [2]*

Table 57—EDMG-MCSs for the EDMG SC mode

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

NOTE – The LDPC code with rate 7/8 can use a superimposed or puncturing code selected by the Superimposed Code Applied field defined in the EDMG-Header-A. The encoding procedure for both cases is described in 30.5.9.4.3.

*Editor: change the text as below, page 291, line 3, [2]*

Table 57—EDMG-MCSs 12 and 13 for the EDMG SC mode if the π/2-8-PSK Applied field is 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EDMG-MCS index | Modulation | NCBPS | Repetition | Code Rate | Data rate per spatial stream (Mbps) | | |
| Normal GI | Short GI | Long GI |
| 12 | π/2-8-PSK | 3 | 1 | 2/3 | *NCB*×3080.00 | *NCB*×3300.00 | *NCB*×2640.00 |
| 13 | π/2-8-PSK | 3 | 1 | 5/6 | *NCB*×3850.00 | *NCB*×4125.00 | *NCB*×3300.00 |

NOTE – The LDPC code with rate 2/3 is generated by employing the original LDPC code with rate 3/4 and applying the codeword shortening procedure to achieve the effective code rate. The LDPC code with rate 5/6 is generated by employing the original LDPC code with rate 7/8 and applying the codeword shortening procedure to achieve the effective code rate. Therefore, similar to the LDPC code with rate 7/8, the LDPC code with rate 5/6 is obtained by using a superimposed or puncturing code selected by the Superimposed Code Applied field defined in the EDMG-Header-A. The encoding procedure for both cases is described in 30.5.9.4.3.

*Editor: change the text as below, page 250, line 1, Table 36, [2]*

|  |  |  |  |
| --- | --- | --- | --- |
| Superimposed Code Applied | 1 | 96 | Corresponds to TXVECTOR parameter LDPC\_SUPERIMPOSED. If the LDPC code rate is 7/8 and this field is set to zero, it indicates puncturing code with codeword length 624 or 1248 is applied.  If the LDPC code rate is 7/8 and this field is set to one, it indicates that superimposed code with codeword length 672 or 1344 is applied.  In all other cases, this field is reserved.  If the EDMG-MCS is 13 and π/2-8-PSK Applied field is one, then this field indicates the 7/8 code employed in the encoding procedure with codeword shortening to achieve the effective code rate of 5/6 as defined in 30.5.9.4.3. |

*Editor: change the text as below, page 220, line 1, Table 27, [2]*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LDPC\_SUPERIMPOSED | FORMAT is EDMG | Indicates whether punctured or superimposed LDPC code is used for code rate 7/8 encoding.  0: indicates that punctured LDPC code is applied as described in 20.6.3.2.3 and 30.5.9.4.3  1: indicates that superimposed LDPC code is applied as described in 30.5.9.4.3  If the EDMG\_MCS is 13 and PSK\_APPLIED is Psk\_Applied, then this field indicates the 7/8 code employed in the encoding procedure with codeword shortening to achieve the effective code rate of 5/6 as defined in 30.5.9.4.3. | Y | Y |

**CID 1616**

*Comment:*

"The value of the EDMG-MCS1 and EDMG-MCS2 fields in the EDMG-Header-A": EDMG-MCS1 +2 field do not exist in header-A.

*Proposed change:*

Revise to "differential EDMG-MCS" or "same as base MCS" or similar.

*Resolution:*

Revised.

*Editor: change the text as below, page 308, line 16 [2]*

The DCM π/2-SQPSK modulation is applied to an EDMG PPDU if, in the EDMG-Header-A, the BW field indicates a bandwidth configuration 2.16+2.16 GHz or 4.32+4.32 GHz, the Channel Aggregation field is set to one, the Number of SS field indicates 2 spatial streams, and the DCM SQPSK Applied field is set to one. The value of the Differential EDMG-MCS1 and Differential EDMG-MCS2 fields in the EDMG-Header-A shall be the same. The resulting EDMG-MCS index shall be in the range from 2 to 6 as defined in Table 60.

**CID 1618**

*Comment:*

"... following the rules defined in 20.6.3.2.4." Subclause reference does not include new modulation formats like 8-PSK or 64-NUC

*Proposed change:*

Please add modulation formats of sections 30.5.9.5.5 and 30.5.9.5.6

*Resolution:*

Accepted.

*Editor: change the text as below, page 309, line 11, [2]*

* Each group of bits , *k* = 0, 1, …, *NSPB* × *NCB* – 1, is converted to the constellation point  following the rules defined in 20.6.3.2.4, 30.5.9.5.5, and 30.5.9.5.6.

**CID 2032**

*Comment:*

The definitions of beamformer and beamformee are not precise for the mm-wave case.

*Proposed change:*

Either avoid the terms or define.

*Resolution:*

Revised.

*Editor: change the text as below, page 313, line 21, [2]*

* Digital beamforming, *NSTS* ≤ *NTX*: the spatial mapping matrix Q is a rectangular matrix of size *NTX* by *NSTS* composed of complex values that might be defined based on some knowledge of the channel..

**CID 1549**

*Comment:*

"The following should be mentioned.

1. The Q matrices may be different for the pre-EDMG fields and the EDMG fields. e.g. using spatial expansion for the pre-EDMG and direct mapping for the EDMG field.

2. Then, normalization on the power should be mentioned to have normalized power between pre-EDMG and EDMG fields. Also, note that the waveform with normalized Hadamard matrix (e.g. [1 1; 1 -1]) has different power from waveform with the identity matrix."

*Proposed change:*

As per comment

*Resolution:*

Revised.

*Editor: add the text as below, page 314, line 7, [2]*

NOTE – the spatial mapping matrix Q may be different for the pre-EDMG and EDMG fields except for the case of an EDMG SU PPDU transmitted over a 2.16 GHz channel with single space-time stream (*iSTS* = 1). The spatial mapping matrix Q shall be normalized to have the same average power per transmit chain for pre-EDMG and EDMG fields.

**CID 1619**

*Comment:*

One important indirect mapping technique is missing: Q may be a direct mapping matrix with interchanged rows and columns.

*Proposed change:*

as in comment

*Resolution:*

Revised.

*Editor: change the text as below, page 313, line 15, [2]*

* Indirect mapping, *NSTS* = *NTX*: the spatial mapping matrix Q is a square matrix of size *NTX* composed of complex values that might be defined as follows:
* normalized discrete Fourier matrix
* normalized Hadamard matrix
* normalized direct mapping diagonal matrix with permuted rows and/or columns

**CID 1916**

*Comment:*

typo on r^{itx(3)}

*Proposed change:*

fix typo

*Resolution:*

Accepted.

*Editor: change the text as below, page 315, line 9, [2]*



**CID 1928**

*Comment:*

Change "digital beamforming" to "digital baseband beamforming".

*Proposed change:*

Change "digital beamforming" to "digital baseband beamforming".

*Resolution:*

Accepted.

*Editor: change the text as below, page 314, line 24, [2]*

In case of digital baseband beamforming transmission, the non-EDMG PPDU waveform for the *iTXth* transmit chain shall be defined as:

*Editor: change the text as below, page 318, line 18, [2]*

In case of digital baseband beamforming transmission, the PPDU waveform of the pre-EDMG and Data fields for the *iTXth* transmit chain shall be defined as:

*Editor: change the text as below, page 320, line 14, [2]*

In case of digital baseband beamforming transmission, the PPDU waveform of the pre-EDMG fields for the *iTXth* transmit chain shall be defined as:

*Editor: change the text as below, page 324, line 7, [2]*

In case of direct mapping, indirect mapping and digital baseband beamforming, the EDMG preamble and Data field waveform for the *iTXth* transmit chain shall be defined as:

*Editor: change the text as below, page 327, line 6, [2]*

In case of direct mapping, indirect mapping and digital baseband beamforming, the EDMG preamble, EDMG-Header-B and Data field waveform for the *iTXth* transmit chain shall be defined as:

*Editor: change the text as below, page 313, line 8, [2]*

This standard defines four basic mappings for the EDMG PHY, namely, direct mapping, indirect mapping, digital baseband beamforming and spatial expansion. Provided below are examples of spatial mapping methods and Q matrices that might be used in different cases.

*Editor: change the text as below, page 313, line 19, [2]*

* Digital baseband beamforming, *NSTS* ≤ *NTX*: the spatial mapping matrix Q is a rectangular matrix of size *NTX* by *NSTS* composed of complex values that might be defined based on some knowledge of the channel between beamformer and beamformee.

**CID 1399**

*Comment:*

Since the statement "The total number of transmit chains, NTX, shall be constant over the different fields of the PPDU." is valid for all sub-clauses within 30.5.10.4, move it from 30.5.10.4.1 to 30.5.10.4.

*Proposed change:*

As suggested.

*Resolution:*

Revised.

*Editor: change the text as below, page 317, line 6, add subclause “General“, [2]*

* + - 1. EDMG SU PPDU transmission

**30.5.10.4.1 General**

An EDMG SC mode SU PPDU transmitted over a 2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, and 4.32+4.32 GHz channel with single and multiple space-time streams (*iSTS* ≥ 1) is composed of pre-EDMG fields, EDMG preamble, Data field and TRN field. The EDMG preamble and TRN field may not be present for particular transmission parameters. The total number of transmit chains, *NTX*, shall be constant over the different fields of an EDMG SU PPDU.

30.5.10.4.2 PPDU transmission over a 2.16 GHz channel with *iSTS* = 1

An EDMG SC mode SU PPDU transmitted over a 2.16 GHz channel with single space-time stream (*iSTS* = 1) is composed of pre-EDMG, Data and TRN fields.

*Editor: change the text as below, page 362, line 11, [2]*

30.5.10.5.1.1 General

The EDMG SC mode MU PPDU transmitted over a 2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, and 4.32+4.32 GHz channel with multiple space-time streams (*iSTS* > 1) for two or more users (*iuser* > 1) is composed of pre-EDMG fields, EDMG preamble, EDMG-Header-B field, Data field and TRN field. The TRN field may not be present for particular transmission parameters. The total number of transmit chains, *NTX*, shall be constant over the different fields of an EDMG MU PPDU.

**CID 1668**

*Comment:*

Duplicate subclause name.

*Proposed change:*

Remove duplicate subclause name.

*Resolution:*

Accepted.

*Editor: change the text as below, page 326, line 10, [2]*

30.5.10.5 EDMG MU PPDU transmission

**CID 1517**

*Comment:*

The function "length(x)" is not defined.

*Proposed change:*

"change P320L25-26 as follows

""where N is the number of symbols in the non-EDMG PPDU, and defined as N=(T\_L-STF + T\_L-CEF + T\_L-Header + T\_EDMG-Header-A) / Tc"""

*Resolution:*

Revised.

*Editor: change the text as below, page 315, line 3, [2]*

where:

 is the total number of chips in the non-EDMG PPDU waveform

*Editor: change the text as below, page 315, line 12, [2]*

where:

 is the length of  in samples



 is the total number of chips in the non-EDMG PPDU waveform

*Editor: change the text as below, page 318, line 31, [2]*

where:

 is the total number of chips in the pre-EDMG and Data fields of the EDMG PPDU waveform

*Editor: change the text as below, page 319, line 15, [2]*

where:

 is the length of  in samples



 is the total number of chips in the EDMG PPDU waveform

*Editor: change the text as below, page 320, line 26, [2]*

where:

 is the total number of chips in the pre-EDMG field of the EDMG PPDU waveform

*Editor: change the text as below, page 321, line 8, [2]*

where:

 is the length of  in samples



 is the total number of chips in the pre-EDMG field of the EDMG PPDU waveform

*Editor: change the text as below, page 324, line 22, [2]*

where:

 is the total number of chips in the EDMG preamble and Data fields of the EDMG PPDU waveform

*Editor: change the text as below, page 325, line 15, [2]*

where:

 is the length of  in samples



 is the total number of chips in the EDMG preamble, Data, and TRN fields of the EDMG PPDU waveform

*Editor: change the text as below, page 328, line 7, [2]*

where:

 is the length of  in samples



 is the total number of chips in the EDMG preamble, EDMG-Header-B, Data, and TRN fields of the EDMG PPDU waveform

**CID 1518**

*Comment:*

"If delta.t1 and delta.t2 intend delay, -delta.t1 and -delta.t2 instead of +delta.t1 and +delta.t2 should be used in the equation.

The similar comments for P322L3 (case of 6.48 GHz), P322L10 (case of 8.48 GHz.)"

*Proposed change:*

As per comment

*Resolution:*

Revised.

*Editor: change the text as below, page 316, line 4, [2]*

where:

∆F defines the channel spacing and is equal to 2.16 GHz

∆t1 and ∆t2 are in the range [0, *Tc*]

∆t equal to 0 corresponds to the primary channel

*Editor: change the text as below, page 316, line 11, [2]*

where:

∆t1, ∆t2 and ∆t3 are in the range [0, *Tc*]

∆t equal to 0 corresponds to the primary channel

*Editor: change the text as below, page 317, line 1, [2]*

∆t1, ∆t2, ∆t3 and ∆t4 are in the range [0, *Tc*]

∆t equal to 0 corresponds to the primary channel

*Editor: change the text as below, page 321, line 18, [2]*

∆t1 and ∆t2 are in the range [0, *Tc*]

∆t equal to 0 corresponds to the primary channel

*Editor: change the text as below, page 322, line 5, [2]*

∆t1, ∆t2 and ∆t3 are in the range [0, *Tc*]

∆t equal to 0 corresponds to the primary channel

*Editor: change the text as below, page 322, line12, [2]*

where:

∆t1, ∆t2, ∆t3 and ∆t4 are in the range [0, *Tc*]

∆t equal to 0 corresponds to the primary channel

**CID 1519**

*Comment:*

"typo in the equation:

use t\_EDMG\_STF instead of t\_TRN.

The same comment for MU case, P328L11"

*Proposed change:*

"Change -t\_TRN to -t\_EDMG\_STF in the equation, P326L1.

Change the text in P326L2-4 as follows:

""where

t\_EDMG\_STF = t\_EDMG\_Header-A + T\_EDMG\_Header\_A is the total duration of the L-STF, L-CEF, L-Header and EDMG-Header-A of the PPDU."

*Resolution:*

Accepted.

*Editor: change the text as below, page 326, line 1, [2]*

The EDMG SC mode SU PPDU waveform for the *iTXth* transmit chain concatenates the pre-EDMG fields, EDMG preamble, Data field, and TRN field and shall be defined as:



where:

 is the total duration of the L-STF, L-CEF, L-Header, and EDMG-Header-A fields of the PPDU

*Editor: change the text as below, page 328, line 11, [2]*

The EDMG SC mode MU PPDU waveform for the *iTXth* transmit chain concatenates the pre-EDMG fields, EDMG preamble, EDMG-Header-B, Data field, and TRN field and shall be defined as:



where:

is the total duration of the L-STF, L-CEF, L-Header, and EDMG-Header-A fields of the PPDU

The definition of the pulse shaping filter impulse response, , and the *Nup* parameter are implementation dependent.

**CID 1516**

*Comment:*

To make consistent with EDMG modulated fields, the normalization factor, 1/sqrt(N\_TX), shall be applied to the pre-EDMG fields. Also, Q matrix for the pre-EDMG may not always the 1st column of the Q matrix for the EDMG fields.

*Proposed change:*

Use different variable, e.g. Q\_pre-EDMG, and apply normalization factor, 1/sqrt(N\_TX).

*Resolution:*

Rejected.

*Discussion:*

Q matrix in this case is a column vector, this is not the first column of the larger matrix.

It is said explicitly in the text that Q matrix for pre-EDMG and EDMG fields may be different.

The normalization coefficient 1/sqrt(N\_TX) is not applied for EDMG field.

**SP:**

Do you agree to approve the proposed resolutions for CIDs 1511, 1512, 1929, 1513, 1930, 1932, 2177, 1931, 1514, 1933, 1515, 1414, 1614, 1615, 1270, 1271, 1812, 1813, 1814, 1822, 1312, 1616, 1618, 2032, 1549, 1619, 1916, 1928, 1399, 1668, 1517, 1518, 1519, 1516 in (11-18-0308-03-00ay CID Resolution - Part V)?

**References:**

1. 11-18-0067-01-00ay-11ay-d1-0-comment-database
2. Draft P802.11ay\_D1.0