IEEE P802.11
Wireless LANs

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| CID Resolution – Part VI, Clause 30.6 |
| Date: 2018-03-25 |
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Abstract

This document proposes resolution for CIDs 1315, 1626, 1316, 2093, 1317, 2094, 1815, 1816, 1625, 1320, 1318, 1319, 1623, 1621, 1534, 1622, 1322, 1969, (18) [1].

**CID 1315**

*Comment:*

"scrambler defined in 20.5.3.2.2" - it is not a good idea to reference 20.5.3.2.2 because it will be removed before TGay finishes the specs

*Proposed change:*

Replace with "scrambler defined in 20.3.9

*Resolution:*

Revised.

*Editor: change the text as below, page 335, line 14, [2]*

*PNSP(iSTS, k)* defines pilot for *iSTS*th space-time stream and *k*th subcarrier

*W(iSTS, n)* × (2×*p(n)* – 1) defines a common phase shift (over subcarriers) for the *iSTS*th space-time stream and *n*th OFDM symbol, *p(n)* defines a bit coming from the scrambler defined in 30.6.8.1 with shift register x1, x2,…, x7 initialized to all ones at the zeroth (i.e., *n* = 0) OFDM symbol

*NSTS* defines the total number of space-time streams

**CID 1626**

*Comment:*

One important indirect mapping technique is missing. Q\_k 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 363, line 17, [2]*

Spatial mapping defines the method of NSTS space-time streams to NTX transmit chains mapping, where NSTS ≤ NTX. This may be implemented by means of spatial mapping matrix Qk of size NTX by NSTS defined per subcarrier basis or cyclic shift diversity (CSD).

The standard defines four basic mappings, including direct mapping, indirect mapping, digital baseband beamforming, and spatial expansion. Examples of spatial mapping methods and Qk matrices that might be used in different cases are as follows:

* Direct mapping, NSTS = NTX: spatial mapping matrix Qk is a square diagonal complex matrix of size NTX that might be defined as follows:
* , the identity matrix
* , the exponential matrix
* Indirect mapping, NSTS = NTX: spatial mapping matrix Qk 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
* Digital baseband beamforming, NSTS ≤ NTX: spatial mapping matrix Qk is a rectangular matrix of size NTX by NSTS composed of complex values that might be defined based on the knowledge of the channel between beamformer and beamformee.
* Spatial expansion, NSTS = 1 < NTX: spatial expansion is performed by application of CSD over different transmit chains. The cyclic shift is applied to the number of consecutive fields in the PPDU. This allows duplication of the PPDU fields transmission over the NTX transmit chains and avoids unintentional beamforming existing with a coherent signal transmission.

**CID 1316, 2093, 1317, 2094**

*Comment:*

In the formula, range of variable q needs to be define (i.e. 0-NFFT\*NCB-1) or similar

What is the variable q?

Missing a formula that would sum $r\_{EDMG\_CEF}^{n,i\_TX}$ to get $r\_{EDMG\_CEF}^{i\_TX}$

What is the variable q?

*Proposed change:*

as in comment

The variable q is undefined. Please defined

Add missing formula

The variable q is undefined. Please defined

*Resolution:*

Revised.

*Editor: change the text as below, page 340, line 28, [2]*

The EDMG-STF field transmit waveform in time domain shall be defined at the OFDM sampling rate Fs equal to NCB×2.64 GHz and sample time duration Ts = 1/Fs ns as follows:



where:

 is 88, 192, 296 and 400 for NCB = 1, 2, 3 and 4 respectively

 is the total number of space-time streams

 is the spatial mapping matrix per kth subcarrier

 is a matrix element from mth row and nth column

 is a window function applied to smooth the transitions between consecutive OFDM symbols, whose definition is implementation dependent

 is the time sample index, 

The fact that only spectral lines of  with indices that are a multiple of four have nonzero amplitude results in a periodicity of TDFT/4=48.48 ns. The interval TEDMG-STF is equal to thirty 48.48 ns periods (i.e., 1.455 µs).

The EDMG-CEF field transmit waveform in time domain shall be defined at the OFDM sampling rate FS = *NCB*×2.64 GHz and sample time duration *TS* = 1/*FS* ns as follows:



where:

 is the total number of active tones

 is the total number of space-time streams

 is the OFDM symbol duration in time domain

 is the long guard interval time duration

 is the spatial mapping matrix per *kth* subcarrier

 is the EDMG-CEF mapping matrix defined below

 is the number of OFDM symbols in the EDMG-CEF for a given total number of space-time streams *NSTS* defined below

 is a matrix element from *mth* row and *nth* column

 is the window function applied to smooth the transitions between consecutive OFDM symbols. Its definition is implementation dependent

 is the time sample index, 

*Editor: change the text as below, page 329, line 1, [2]*

* 1. EDMG OFDM mode

30.6.1 General

Transmission and reception of SU and MU 2.16 GHz PPDU, 4.32 GHz PPDU, 6.48 GHz PPDU, 8.64 GHz PPDU, 2.16+2.16 GHz PPDU, and 4.32+4.32 GHz PPDU using EDMG OFDM mode with single and multiple spatial streams is optional.

30.6.2 OFDM signal parameters

30.6.2.1. General

This subclause defines main EDMG OFDM 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 (*NCB* = 2) transmissions.

30.6.2.2 Timing related parameters

Table 71 provides a summary of the timing related parameters of the EDMG OFDM mode.

Table 71—EDMG OFDM mode timing related parameters

|  |  |
| --- | --- |
| Parameter | Value |
| *NCB* = 1 | *NCB* = 2 | *NCB* = 3 | *NCB* = 4 |
| *NSD*: Number of data subcarriers | 336 | 734 | 1134 | 1532 |
| *NSP*: Number of pilot subcarriers | 16 | 36 | 56 | 76 |
| *NDC*: Number of DC subcarriers | 3 | 3 | 3 | 3 |
| *NST*: Total number of subcarriers | 355 | 773 | 1193 | 1611 |
| *NSR*: Number of subcarriers occupying half of the overall BW | 177 | 386 | 596 | 805 |
| *NGI short*: short guard interval length | 48 | 96 | 144 | 192 |
| *NGI normal*: normal guard interval length | 96 | 192 | 288 | 384 |
| *NGI long*: long guard interval length | 192 | 384 | 576 | 768 |
| ∆*F*: Subcarrier frequency spacing | 5.15625 MHz | 5.15625 MHz | 5.15625 MHz | 5.15625 MHz |
| *Fs*: EDMG OFDM sample rate | 2.64 GHz | 5.28 GHz | 7.92 GHz | 10.56 GHz |
| *Ts*: EDMG OFDM sample time | 0.38 ns | 0.19 ns | 0.13 ns | 0.09 ns |
| *NDFT:* DFT size | 512 | 1024 | 1536 | 2048 |
| *TDFT*: OFDM IDFT/DFT period | 0.194 µs | 0.194 µs | 0.194 µs | 0.194 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 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. Then the resampling procedure is applied with 3/2 sample rate conversion ratio to achieve the effective sample rate of 2.64 GHz and sample time duration of 0.38 ns. The EDMG modulated fields are defined at the EDMG OFDM sample rate *Fs* = 2.64×*NCB* GHz and the corresponding sample time duration *Ts* = 1 / (2.64×*NCB*) ns.

**CID 1815, 1816**

*Comment:*

Spelling mistake "codewrod"

Spelling mistake "inculsive"

*Proposed change:*

change spelling to "codeword"

change spelling to "inclusive"

*Resolution:*

Accepted.

*Editor: change the text as below, page 343, line 20, [2]*

* For a PPDU transmitted over a NCB × 2.16 GHz channel, where 1 ≤ NCB ≤ 4, the data block is defined as a repetition of codeword  bits as follows:

*Editor: change the text as below, page 345, line 15, [2]*

In the above description, the c11:m and c21:m notations define an array of vector c1 and c2 elements starting from the first bit (inclusive) and ending at the mth bit (inclusive).

**CID 1625**

*Comment:*

Reference to Section 20.5.3.2.4 is not applicable as OFDM is deprecated in 11ad

*Proposed change:*

Refer to OFDM modulation section in 11ay amendment

*Resolution:*

Revised.

*Editor: change the text as below, page 359, line 15, [2]*

1. Each group of bits , *k* = 0, 1, …, *NSD* - 1 is converted to the constellation point , *q* = 0, 1, …, *NSYM* - 1,following the rules defined in 30.6.8.3.3, 30.6.8.3.5, 30.6.8.3.6, and 30.6.8.3.7.

*Editor: change the text as below, page 360, line 14, [2]*

In the above procedure, index *n* = 0, 1, …, *NSYM* / 2– 1, pilot sequences *PNSP*(*iSTS* = 1, *k*) and *PNSP*(*iSTS* = 2, *k*) are defined in 30.6.1.6 and *p*(*n*) defines a bit coming from the scrambler defined in 30.6.8.1 with shift register x1, x2,…, x7 initialized to all ones for the *n* = 0 OFDM symbol.

**CID 1320**

*Comment:*

Modulation is applied only at the transmitter.

*Proposed change:*

replace receiver by transmitter

*Resolution:*

Revised.

*Editor: change the text as below, page 360, line 20, [2]*

The phase hopping modulation is applied if the number of spatial streams is equal to two (i.e., NSS = 2) and the Phase Hopping field in the EDMG-Header-A is equal to 1.

**CID 1318**

*Comment:*

Add a reference to 30.6.8.3.8 where tone pairing is defined

*Proposed change:*

as in comment

*Resolution:*

Accepted.

*Editor: change the text as below, page 354, line 27, [2]*

where index *P(k)* is defined in the range NSD/2 to NSD – 1 in 30.6.8.3.8. The qth modulated data block of the iSSth spatial stream is mapped to NSD data subcarriers of the qth OFDM symbol of the iSSth spatial stream.

**CID 1319**

*Comment:*

Add a reference to 30.6.8.3.8 where tone pairing is defined

*Proposed change:*

as in comment

*Resolution:*

Accepted.

*Editor: change the text as below, page 356, line 11, [2]*

where index *P(k)* is defined in the range NSD/2 to NSD – 1 in 30.6.8.3.8. The qth modulated data block of the iSSth spatial stream is mapped to NSD data subcarriers of the qth OFDM symbol of the iSSth spatial stream.

**CID 1623**

*Comment:*

QPSK for OFDM has incorrect bit assignment

*Proposed change:*

c\_2k, c\_2k+1, c\_2k+2, c\_2k+3 seems to contradict to mapping described below. c\_4k, c\_4k+1, c\_4k+2, c\_4k+3 would do it

*Resolution:*

Accepted.

*Editor: change the text as below, page 356, line 3, [2]*

The input encoded bits of the iSSth spatial stream are broken into the groups of NCBPS bits, , where q denotes the group number. Each four bits, k = 0, 1, …, NSD/2 – 1, are converted into the pair of complex points .

**CID 1621, 1534**

*Comment:*

16-QAM for OFDM has incorrect bit assignment

"The line feed in the equation looks strange. It may look a 2x1 vector at a glance.

The same comment for 64-QAM (P357L1)"

*Proposed change:*

Instead of c\_2k, c\_2k+1, c\_2k+2, c\_2k+3 it should be c\_4k, c\_4k+1, ...

1/sqrt(10) should appear only on the first line

*Resolution:*

Accepted.

*Editor: change the text as below, page 356, line 14, [2]*

The input encoded bits of the iSSth spatial stream are broken into the groups of NCBPS bits, , where q denotes the group number. Each four bits, k = 0, 1, …, NSD – 1, are converted into the single constellation point . The modulation is performed as follows:



The qth modulated data block of the iSSth spatial stream is mapped to NSD data subcarriers of the qth OFDM symbol of the iSSth spatial stream.

**CID 1622**

*Comment:*

64-QAM for OFDM has incorrect bit assignment

*Proposed change:*

Instead of c\_2k, c\_2k+1, c\_2k+2, ... it should be c\_6k, c\_6k+1, c\_6k+2, ...

*Resolution:*

Accepted.

*Editor: change the text as below, page 356, line 23, [2]*

The input encoded bits of the iSSth spatial stream are broken into the groups of NCBPS bits, , where q denotes the group number. Each six bits, k = 0, 1, …, NSD – 1, are converted into the single constellation point . The modulation is performed as follows:



The qth modulated data block of the iSSth spatial stream is mapped to NSD data subcarriers of the qth OFDM symbol of the iSSth spatial stream.

**CID 1322**

NOTE – CID 1969 has identical text as CID 1322

*Comment:*

"To align the sampling rate over the SC and OFDM modulated fields, the pre-EDMG part of the preamble of an OFDM mode PPDU shall be defined at the Nup├ù1.76 GHz sampling rate, where Nup = (3/2)├ùNCB." This terminology is poor. The pre OFDM part is defined at Tc which is actually 2/3 of TS

*Proposed change:*

Replace with "The pre EDMG part of the preamble is defined in Tc = 2/3Ts"

*Resolution:*

Revised.

*Editor: change the text as below, page 364, line 21, [2]*

30.6.9.3.2 Pre-EDMG part of PPDU transmission

See 30.5.10.4.2.2. The up-sampling factor shall be equal to *Nup* = (3/2)×*NCB*.

*Editor: change the text as below, page 366, line 17, [2]*

* + - * 1. Pre-EDMG part of PPDU transmission

See 30.5.10.4.2.2. The up-sampling factor shall be equal to *Nup* = (3/2)×*NCB*.

**SP:**

Do you agree to accept the proposed comment resolution for CIDs 1315, 1626, 1316, 2093, 1317, 2094, 1815, 1816, 1625, 1320, 1318, 1319, 1623, 1621, 1534, 1622, 1322, 1969 in (11-18-0325-01-00ay CID Resolution - Part VI)?

**References:**

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