IEEE P802.11  
Wireless LANs

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| CID Resolution – Part I, Clause 30.1, 30.10, 30.11 | | | | |
| Date: 2018-01-17 | | | | |
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Abstract

This document proposes resolution for CIDs 1875, 1982, 1391, 2036, 1418, 1419, 1715, 1716, 2037, 2038, 1599, 2039, 2105, 2106, 2107, 1935 [1]. (16)

**CID 1875, 1982**

*Comment:*

The current spec defines complementary Golay sequences by Ga, Gb, GA and GB. The fact that we have a & A and b and B (lower case and upper case) is very confusing. I would like to suggest to use Gc and Gd instead of GA and GB.

*Proposed change:*

Rename GA to Gc and GB to Gd

*Resolution:*

Accepted.

*Editor:*

Rename (GA, GB) with (Gc, Gd) in all places in the D1.0.

**CID 1391, 2036**

*Comment:*

The sentence states that the clause specifies the PHY entity for EDMG SC and EDMG OFDM systems. Sub-clause 30.4 defines a third EDMG modulation type: EDMG control mode, which is not mentioned in 30.1.1.

*Proposed change:*

Mention the specification of an EDMG control mode somewhere in 30.1.1?

*Resolution:*

Revised.

*Editor: change the text as below, page 216, line 6, [2]*

This clause specifies the PHY entity for the enhanced directional multi-gigabit (EDMG) control, single carrier (SC) and orthogonal frequency division multiplexing (OFDM) modes.

**CID 1418**

*Comment:*

2.16 GHz is the minimum width of a channel. The term 2.16 GHz contiguous channel width does not apply.

*Proposed change:*

Change the statement to: "2.16 GHz channel width and 4.32 GHz contiguous channel width"

*Resolution:*

Revised.

*Editor: change the text as below, page 216, line 19, [2]*

An EDMG STA shall support the following features:

* EDMG format (transmit and receive)
* 2.16 GHz PPDU using EDMG control mode and SC mode (transmit and receive)
* 4.32 GHz PPDU using EDMG control mode and SC mode (transmit and receive)
* Single spatial stream (transmit and receive) in all supported channel widths
* 2.16 GHz PPDU using non-EDMG control mode MCS0 and SC mode MCSs 1 – 4 (transmit and receive)
* 4.32 GHz PPDU using non-EDMG duplicate control mode MCS0 and SC mode MCSs 1 – 4 (transmit and receive)

**CID 1419**

*Comment:*

Should make it clear that for all channel widths that an EDMG STA supports, it must support single spatial stream on both transmit and receive.

*Proposed change:*

Single spatial stream (transmit and receive) in all channel widths that the EDMG STA supports

*Resolution:*

Accepted.

*Editor: change the text as below, page 216, line 20, [2]*

An EDMG STA shall support the following features:

* EDMG format (transmit and receive)
* 2.16 GHz and 4.32 GHz contiguous channel widths
* Single spatial stream (transmit and receive) in all channel widths that the EDMG STA supports
* Non-EDMG duplicate format transmission for MCS0 and MCSs 1 – 4

**CID 1715**

*Comment:*

Apply meaning to the term 2.16+2.16 GHz channel width. Don't assume the reader is familiar with the 11ac 80+80 MHz meaning.

*Proposed change:*

An EDMG STA may support 2.16+2.16 GHz and 4.32+4.32 GHz channel widths consisting of two non-contiguous 2.16 GHz or two non-contiguous 4.32 GHz channels, respectively.

*Resolution:*

Revised.

*Editor: change the text as below, page 216, line 10, [2]*

The EDMG PHY is based on the DMG PHY defined in Clause 20. The EDMG PHY adds support for space-time streams, downlink multi-user (MU) transmissions and multiple channel widths, including 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, and 4.32+4.32 GHz PPDU transmissions. The channels making up a 2.16+2.16 GHz and 4.32+4.32 GHz PPDU transmission may be contiguous or non-contiguous. The maximum number of spatial streams per STA is eight. A MU PPDU transmission supports up to eight STAs. For 2.16+2.16 GHz or 4.32+4.32 GHz transmissions, the maximum number of spatial streams in each channel is four.

*Editor: add the following definitions in Clause 3.2:*

**2.16 GHz physical layer (PHY) protocol data unit (PPDU):** A Clause 30 2.16 GHz enhanced directional multi gigabit (EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW216 and FORMAT equal to EDMG) or a Clause 30 2.16 GHz non-enhanced directional multi gigabit (non-EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW216 and FORMAT equal to NON\_EDMG).

**4.32 GHz physical layer (PHY) protocol data unit (PPDU):** A Clause 30 4.32 GHz enhanced directional multi gigabit (EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW432 and FORMAT equal to EDMG) or a Clause 30 4.32 GHz non-enhanced directional multi gigabit (non-EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW432 and FORMAT equal to NON\_EDMG).

**2.16+2.16 GHz physical layer (PHY) protocol data unit (PPDU):** A Clause 30 2.16+2.16 GHz enhanced directional multi gigabit (EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW216+216 and FORMAT equal to EDMG) or a Clause 30 2.16+2.16 GHz non-enhanced directional multi gigabit (non-EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW216+216 and FORMAT equal to NON\_EDMG).

**6.48 GHz physical layer (PHY) protocol data unit (PPDU):** A Clause 30 6.48 GHz enhanced directional multi gigabit (EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW648 and FORMAT equal to EDMG) or a Clause 30 6.48 GHz non-enhanced directional multi gigabit (non-EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW648 and FORMAT equal to NON\_EDMG).

**8.64 GHz physical layer (PHY) protocol data unit (PPDU):** A Clause 30 8.64 GHz enhanced directional multi gigabit (EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW864 and FORMAT equal to EDMG) or a Clause 30 8.64 GHz non-enhanced directional multi gigabit (non-EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW864 and FORMAT equal to NON\_EDMG).

**4.32+4.32 GHz physical layer (PHY) protocol data unit (PPDU):** A Clause 30 4.32+4.32 GHz enhanced directional multi gigabit (EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW432+432 and FORMAT equal to EDMG) or a Clause 30 4.32+4.32 GHz non-enhanced directional multi gigabit (non-EDMG) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to CBW432+432 and FORMAT equal to NON\_EDMG).

**CID 1716**

*Comment:*

Apply meaning to the term 2.16+2.16 GHz channel width. Don't assume the reader is familiar with the 11ac 80+80 MHz meaning.

*Proposed change:*

2.16+2.16 GHz channel widths comprising two non-contiguous 2.16 GHz channels

*Resolution:*

Revised.

*Editor: change the text as below, page 216, line 26, [2]*

An EDMG STA may support the following features:

* Two or more spatial streams (transmit and receive) using SC or OFDM modulations
* EDMG MU PPDUs (transmit and receive) using SC or OFDM modulations
* 2.16+2.16 GHz PPDU using EDMG control mode MCS0, SC and OFDM mode all MCSs (transmit and receive)4.32+4.32 GHz PPDU using EDMG control mode MCS0, SC and OFDM mode all MCSs (transmit and receive)6.48 GHz PPDU using EDMG control mode MCS0, SC and OFDM mode all MCSs (transmit and receive)8.64 GHz PPDU using EDMG control mode MCS0, SC and OFDM mode all MCSs (transmit and receive)2.16+2.16 GHz PPDU using non-EDMG duplicate control mode MCS0 and SC mode all MCSs (transmit and receive)
* 4.32+4.32 GHz PPDU using non-EDMG duplicate control mode MCS0 and SC mode all MCSs (transmit and receive)
* 6.48 GHz PPDU using non-EDMG duplicate control mode MCS0 and SC mode all MCSs (transmit and receive)
* 8.64 GHz PPDU using non-EDMG duplicate control mode MCS0 and SC mode all MCSs (transmit and receive)
* A 64-point non-uniform constellation
* 8-PSK using SC modulation

**CID 2037**

*Comment:*

Second paragraph assumes that EDMG PHY is based on DMG PHY, so why not insert text before second paragraph

*Proposed change:*

Move "The EDMG PHY is based on the DMG PHY defined in Clause 20" from line 10 to before line 8, i.e., at the start of the second paragraph

*Resolution:*

Accepted.

*Editor: change the text as below, page 216, line 8, [2]*

In addition to the requirements in this clause, an EDMG STA shall be capable of transmitting and receiving PPDUs that are compliant with the mandatory PHY specifications defined in Clause 20.

The EDMG PHY adds support for space-time streams, downlink multi-user (MU) transmissions and multiple channel widths. The maximum number of spatial streams per STA is eight. A MU PPDU transmission supports up to eight STAs. For 2.16+2.16 GHz or 4.32+4.32GHz transmissions, the maximum number of spatial streams in each channel is four.

**CID 2038, 1599**

*Comment:*

STBC is missing from list of optional features

The listing of what is a mandatory or optional feature seems not to be complete

*Proposed change:*

Add STBC to the list

Complete the list

*Resolution:*

Revised.

*Editor: change the text as below, page 216, line 17, [2]*

An EDMG STA shall support the following features:

* EDMG format (transmit and receive)
* 2.16 GHz PPDU using EDMG control mode MCS0 and SC mode MCSs 1 – 5 and 7 – 10 (transmit and receive)
* 4.32 GHz PPDU using EDMG control mode MCS0 and SC mode MCSs 1 – 5 and 7 – 10 (transmit and receive)
* 2.16 GHz and 4.32 GHz contiguous channel widths
* Single spatial stream (transmit and receive) in all supported channel widths
* Normal GI type
* Non-EDMG duplicate format transmission MCS0 and MCSs 1 – 4

An EDMG STA may support the following features:

* 2.16 GHz PPDU using EDMG SC mode MCSs 6 and 11 – 20 and OFDM mode all MCSs (transmit and receive)
* 4.32 GHz PPDU using EDMG SC mode MCSs 6 and 11 – 20 and OFDM mode all MCSs (transmit and receive)
* Two or more spatial streams using EDMG SC and OFDM mode (transmit and receive)
* EDMG MU PPDUs using EDMG SC and OFDM mode (transmit and receive)
* 2.16+2.16 GHz channel widths
* 4.32+4.32 GHz channel widths
* 6.48 GHz channel width
* 8.64 GHz channel width
* Short and long GI type
* SU A-PPDU (transmit and receive)
* STBC (transmit and receive)
* DCM π/2-SQPSK using EDMG SC mode (transmit and receive)
* π/2-64-NUC using EDMG SC mode (transmit and receive)
* π/2-8-PSK using EDMG SC mode (transmit and receive)

*Editor: change the text as below, page 290, line 31, [2]*

Transmit and receive support for MCSs 1 - 5 and 7 - 10 is mandatory. Other MCSs are optional. MCS indexes exceeding the largest MCS index defined in Table 57 are reserved.

**CID 2039**

*Comment:*

Incorrect paragraph return

*Proposed change:*

Move lines 5-7 after the end of line 3

*Resolution:*

Accepted.

*Editor: change the text as below, page 218, line 3, [2]*

For an EDMG STA, the FORMAT parameter determines the overall structure of the PPDU and includes the following:

* Non-EDMG format (NON\_EDMG) based on Clause 20.
* EDMG format (EDMG). PPDUs of this format contain a preamble compatible with Clause 20 STAs. The non-EDMG portion of the EDMG format preamble (the parts of EDMG preamble preceding the EDMG-Header-A field) is defined so that it can be decoded by these STAs. An EDMG PPDU can be further categorized as an EDMG SU PPDU or an EDMG MU PPDU. An EDMG SU PPDU shall not contain the EDMG-Header-B field. An EDMG MU PPDU shall contain the EDMG-Header-B field.

**CID 2105, 2106**

*Comment:*

Tables 90-105 occupies too many pages in the draft

Tables 107-114 occupies to many pages in the draft

*Proposed change:*

Replace tables with the equations for generating the Golay sequences

*Resolution:*

Rejected.

*Discussion:*

The generation of Golay sequences using equations is already defined in the D1.0. However, this is an informative part of the specification and the sequences definition in the tables provides the normative part. The D1.0 reuses the same approach as defined in 802.11ad.

The reasons for using tables (as normative part):

1. Misunderstanding of the generation procedure may lead to mistakes in the sequences, reader implemented and generated the sequences is not able to double check them without tables
2. To generate the sequences, reader needs to implement the generation procedure described in the draft, this is not convenient
3. Additional pages is not a problem for the draft, clarity is more important

**CID 2107**

*Comment:*

There are a lot of zero values in the Tables 115-122. These tables can be shortened by only displaying the non-zero entries and non-zero locations

*Proposed change:*

Replace the tables with new tables that only displaying the non-zero entries and corresponding non-zero locations

*Resolution:*

Rejected.

*Discussion:*

In that case to have the exact definition of the sequence, one needs to define the subcarriers set for non-zero values and not just the subcarriers range. This will create additional rows and increase the table size.

**CID 1935**

*Comment:*

The range of "n" in (A\_0(n), B\_0(n)) should be specified.

*Artyom:* definition of Ga/Gb sequences is missed in the text, see original contribution [3], slide #6.

*Proposed change:*

add "n = 0, 1, 2" at the end of the line

*Resolution:*

Revised.

*Editor: change the text as below, page 424, line 2, [2]*

The Golay sequences of length 96, 192, 384 and 768 use a quadri-phase complex Golay complementary pair and are generated using the following recursive procedure, where *i* is the index of the space-time stream or transmit chain number:

* Ga3 = [+1, +1, -1]
* Gb3 = [+1, +j, +1]
* *If* (*i = 1, 3, 5 or 7*) *then* (*Ai0*(*n*)*, Bi0*(*n*)) = (+Ga3(*2-n*)*, +*Gb3(*2-n*))*. Otherwise if* (*i = 2, 4, 6 or 8*) *then* (*Ai0*(*n*)*, Bi0*(*n*)) = (+*conj*(Gb3(*n*))*, -conj*(Ga3(*n*)))
* *Aik*(*n*) = *WikAik-1*(*n*) + *Bik-1*(*n-Dk*)
* *Bik*(*n*) = *WikAik-1*(*n*) - *Bik-1*(*n-Dk*)

Note that *Aik*(*n*), *Bik*(*n*) are zero for *n* < 0 and for *n* > 3×2*k*. Starting with *k* = 1 and making 5, 6, 7 and 8 iterations, corresponding sequences of length 96, 192, 384 and 768 are obtained.

The Golay sequences are defined as follows, where *i* is the space-time stream or transmit chain number and 1 ≤ *i* ≤ 8:

* Ga*i*96(*n*) = *conj*(*Ai*5(95-*n*)) and Gb*i*96 = *conj*(*Bi*5(95-*n*))
* Ga*i*192(*n*) = *conj*(*Ai*6(191-*n*)) and Gb*i*192 = *conj*(*Bi*6(191-*n*))
* Ga*i*384(*n*) = *conj*(*Ai*7(383-*n*)) and Gb*i*384 = *conj*(*Bi*7*(*383-*n*))
* Ga*i*768(*n*) = *conj*(*Ai*8*(*767-*n*)) and Gb*i*768 = *conj*(*Bi*8(767-*n*))

The value of the DK vector for each of the sequences are defined as follows, where *i* is the space-time stream or transmit chain number and 1 ≤ *i* ≤ 8:

* For Ga*i*96 and Gb*i*96: DK = [3 24 6 12 48]
* For Ga*i*192 and Gb*i*192: DK = [3 24 6 12 48 96]
* For Ga*i*384 and Gb*i*384: DK = [3 24 6 12 48 96 192]
* For Ga*i*768 and Gb*i*768: DK = [3 24 6 12 48 96 192 384]

As opposed to the DK vector, the value of the WiK vector depends on the space-time stream or transmit chain number used to define the Golay pair (Ga*i*96, Gb*i*96), (Ga*i*192, Gb*i*192), (Ga*i*384, Gb*i*384), and (Ga*i*768, Gb*i*768). Table 106 shows the value of the WiK vector defined for each space-time stream or transmit chain.

1. —WiK vector value to generate Golay sequences of length 96, 192, 384 and 768

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Space-time stream *i* transmit chain number | WiK for Ga*i*96 and Gb*i*96 | WiK for Ga*i*192 and Gb*i*192 | WiK for Ga*i*384 and Gb*i*384 | WiK for Ga*i*768 and Gb*i*768 |
| 1 | [-1,-1,-1,-1,+1] | [-1,-1,-1,-1,+1,+1] | [-1,-1,-1,-1,+1,-1,-1] | [-1, -1, -1, -1, +1, -1, -1, +1] |
| 2 |
| 3 | [-1,-1,-1,+1,-1] | [-1,-1,-1,+1,-1,+1] | [-1,-1,-1,+1,-1,-1,+1] | [-1, -1, -1, +1, -1, -1, +1, +1] |
| 4 |
| 5 | [-1,-1,+1,-1,-1] | [-1,-1,+1,-1,-1,+1] | [-1,-1,-1,+1,-1,+1,+1] | [-1, -1, -1, +1, -1, +1, +1, +1] |
| 6 |
| 7 | [-1,-1,+1,+1,-1] | [-1,-1,+1,+1,-1,+1] | [-1,-1,-1,+1,+1,+1,-1] | [-1, -1, -1, +1, +1, +1, -1, +1] |
| 8 |

**SP:**

Do you agree to accept the proposed resolutions for CIDs 1875, 1982, 1391, 2036, 1418, 1419, 1715, 1716, 2037, 2038, 1599, 2039, 2105, 2106, 2107, 1935 in (11-18-0141-02-00ay CID Resolution - Part I)?

**References:**

1. 11-18-0067-01-00ay-11ay-d1-0-comment-database
2. Draft P802.11ay\_D1.0
3. 11-16-1207-00-00ay-sc-phy-edmg-cef-design-for-channel-bonding-x3