IEEE P802.11
Wireless LANs

|  |
| --- |
| Proposed Comment Resolution for CID 63, 68 in 11ay |
| Date: 2017-06-07 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Artyom Lomayev | Intel | Turgeneva 30, Nizhny Novgorod 603024, Russia | +7 (831) 2969444 | artyom.lomayev@intel.com |
| Alexander Maltsev | Intel  |  |  | alexander.maltsev@intel.com |
| Miki Genossar | Intel |  |  | miki.genossar@intel.com |
| Claudio da Silva | Intel |  |  | claudio.da.silva@intel.com |
| Carlos Cordeiro | Intel  |  |  | carlos.cordeiro@intel.com |

Abstract

This document proposes comment resolution for CID 63 and 68, [1], [2]. Also, other editorial changes were introduced.

**Comment CID 63: revised**

*Comment text, p 93, line 1:*

Table of mathematical parameters (as in 20.3.4) is missing

*Discussion:*

This table exists in section 30.6.1.2 in the current spec draft D 0.35.

*Proposed change:*

**30.5.2 SC signal parameters**

*Editor: it is proposed to add subclause 30.5.2 to the spec draft*

**30.5.2.1 General**

This subclause defines main EDMG SC signal parameters for 2.16 GHz, 4.32 GHz, 6.48 GHz, and 8.64 GHz bandwidth transmission.

**30.5.2.2 Timing related parameters**

Table 1 provides a summary of timing-related parameters.

Table 1: Timing-related parameters.

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| *NCB* = 1 | *NCB* = 2 | *NCB* = 3 | *NCB* = 4 |
| *NCB×Fc*: SC chip rate | 1.76 GHz | 3.52 GHz | 5.28 GHz | 7.04 GHz |
| *Tc*/*NCB*: 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 |

**Comment CID 68: revised**

*Comment text, p 143, line 2:*

"The SU PPDU structures described in this subclause cover the combination of different values of NCB and when the number of spatial streams is one" TRN fields are missing from the structures. If this is due to lack of space, it should be mentioned in the text.

*Proposed change:*

**30.5.7.2 Symbol blocking and guard insertion**

*Editor: replace the existing section 30.5.7.2 in the spec draft [1] with the one provided in this document*

**30.5.7.2.1 General**

This subclause defines the symbol blocking and guard interval structure for each type of SC EDMG PPDU. The GIs used to define symbol blocking structure for the pre-EDMG fields, EDMG-Header-B and data field are defined in 30.5.7.1.

The symbol notations for frequently used parameters in this subclause are summarized in Table 1.

Table 1: Frequently used parameters

|  |  |
| --- | --- |
| **Symbol** | **Explanation** |
|  | Space-time stream number |
|  | Total number of space-time streams |
|  | User number |
|  | Total number of users |
|  | Space-time stream number for *iuser*-th user |
|  | Total number of space-time streams for *iuser*-th user |
|  | Transmit chain number |
|  | Total number of transmit chains |
|  | Number of contiguous 2.16 GHz channels used for PPDU transmission, 1 ≤ *NCB* ≤ 4 |
|  | PPDU index number aggregated into the A-PPDU, 0 ≤ *j* ≤ *N* |
|  | Total number of PPDU aggregated into a single A-PPDU |

The SU PPDU symbol blocking and guard interval structure shall be as defined in 30.5.7.2.2. The SU A-PPDU symbol blocking and guard interval structure shall be as defined in 30.5.7.2.3.

The non-FDMA MU PPDU symbol blocking and guard interval structure shall be as defined in 30.5.7.2.4. The FDMA MU PPDU symbol blocking and guard interval structure shall be as defined in 30.5.7.2.5.

**30.5.7.2.2 SU PPDU transmission**

This subclause defines a SU PPDU transmission over a 2.16 GHz channel with single space-time stream (*iSTS* = 1) and PPDU transmission over a 4.32 GHz, 6.48 GHz, and 8.64 GHz channel with single and multiple space-time streams (*iSTS* ≥ 1).

The SU PPDU structure for 2.16 GHz channel and single spatial stream transmission (*iSTS* = 1) shall be as defined in 30.5.7.2.2.1. The SU PPDU structure for 4.32 GHz, 6.48 GHz, 8.64 GHz and multiple space-time streams transmission (*iSTS* ≥ 1) shall be as defined in 30.5.7.2.2.2.

**30.5.7.2.2.1 SU PPDU transmission over 2.16 GHz channel with *iSTS* = 1**

The SU PPDU for 2.16 GHz channel and single space-time stream (*iSTS* = 1) shall be defined at the SC chip rate equal to 1.76 GHz. The PPDU of this type does not include the EDMG-STF and EDMG-CEF fields and the symbol blocking structure defined for the data field continues symbol blocking structure of the pre-EDMG fields.

The SC EDMG SU PPDU symbol blocking structure for the short, normal and long GI shall be as shown in Figure 1, Figure 2, and Figure 3 respectively. An EDMG STA shall support the SU PPDU structure with normal GI as shown in Figure 2.



Figure 1: SU PPDU structure: (2.16 GHz, iSTS = 1), short GI



Figure 2: SU PPDU structure: (2.16 GHz, iSTS = 1), normal GI



Figure 3: SU PPDU structure: (2.16 GHz, iSTS = 1), long GI

The single space-time stream of SU PPDU can be mapped to *NTX* ≥ 1 transmit chains applying direct, indirect spatial mapping or digital beamforming as defined in 30.5.8.4.1.1. The single space-time stream can be mapped to *NTX* ≥ 1 transmit chains applying spatial expansion as defined in 30.5.8.4.1.2.

A TRN field per transmit chain (see 30.9.2.2.5) may be appended to a SU PPDU.

**30.5.7.2.2.2 SU PPDU transmission over 2.16 GHz channel with *iSTS* > 1 and 4.32 GHz, 6.48 GHz, and 8.64 GHz channel with *iSTS* ≥ 1**

The SU PPDU transmission over 2.16 GHz channel with multiple space-time streams (*iSTS* > 1) and SU PPDU transmission over a 4.32 GHz, 6.48 GHz, 8.64 GHz channels with single and multiple space-time streams (*iSTS* ≥ 1) shall be defined at the *NCB*×1.76 GHz, 1 ≤ *NCB* ≤ 4, sampling rate.

The PPDU of this type includes the EDMG-STF and EDMG-CEF fields separating the symbol blocking structure of the data field and pre-EDMG fields.

The symbol blocking structure for pre-EDMG fields transmitted over a 2.16 GHz channel shall be defined at the SC chip rate equal to 1.76 GHz as shown in Figure 4.



Figure 4: SU PPDU structure: pre-EDMG fields’ symbol blocking, 2.16 GHz

To transmit pre-EDMG fields over a 4.32 GHz, 6.48 GHz, and 8.64 GHz channel, the duplicate format defined in 30.5.8.4.2.3 shall be used. The resulting PPDU waveform is defined at the *NCB*×1.76 GHz, *NCB* = 2, 3, and 4.

To transmit pre-EDMG fields using *NTX* > 1 transmit chains, the format using Cyclic Shift Diversity (CSD) defined in 30.5.8.4.2.3 shall be used.

The symbol blocking structure for the data field of the SU PPDU for the short, normal and long GI shall be as shown in Figure 5, Figure 6, and Figure 7 respectively.



Figure 5: SU PPDU structure: data field symbol blocking, (2.16 GHz, iSTS > 1) or (4.32 GHz, 6.48 GHz, 8.64 GHz, iSTS ≥ 1), short GI



Figure 6: SU PPDU structure: data field symbol blocking, (2.16 GHz, iSTS > 1) or (4.32 GHz, 6.48 GHz, 8.64 GHz, iSTS ≥ 1), normal GI



Figure 7: SU PPDU structure: data field symbol blocking, (2.16 GHz, iSTS > 1) or (4.32 GHz, 6.48 GHz, 8.64 GHz, iSTS ≥ 1), long GI

The *NSTS* space-time streams of SU PPDU can be mapped to *NTX* (*NSTS* ≤ *NTX*) transmit chains applying direct, indirect spatial mapping or digital beamforming as defined in 30.5.8.4.2.1. The single space-time stream can be mapped to *NTX* ≥ 1 transmit chains applying spatial expansion as defined in 30.5.8.4.2.2.

A TRN field per transmit chain (see 30.9.2.2.5) may be appended to a SU PPDU.

**30.5.7.2.3 SU A-PPDU transmission**

*Editor: keep unchanged as in section 30.5.7.2.4 in the current spec draft [1]*

**30.5.7.2.4 MU non-FDMA PPDU transmission**

This subclause defines a MU non-FDMA PPDU transmission over a 2.16 GHz, 4.32 GHz, 6.48 GHz, and 8.64 GHz using multiple space-time streams (*iSTS* > 1) for two or more users (*iuser* > 1).

For MU non-FDMA PPDU transmission the space-time stream index *iSTS* is related to the space-time stream index per user  as follows:



where

*  is a total number of space-time streams
*  is a total number of users
*  is the number of space-time streams per *iuser*-th user

As opposed to the SU PPDU, the MU PPDU includes the EDMG-Header-B. Similar to the SU PPDU transmission the EDMG-Header-B and data symbol blocking structure is separated from the pre-EDMG fields’ symbol blocking structure by EDMG-STF and EDMG-CEF fields.

The symbol blocking structure for pre-EDMG fields transmitted over a 2.16 GHz channel shall be defined at the SC chip rate equal to 1.76 GHz as shown in Figure 4.

To transmit pre-EDMG fields over a 4.32 GHz, 6.48 GHz, and 8.64 GHz channel, the duplicate format defined in 30.5.8.4.2.3 shall be used. The resulting PPDU waveform is defined at the *NCB*×1.76 GHz, *NCB* = 2, 3, and 4.

To transmit pre-EDMG fields using *NTX* > 1 transmit chains, the format using Cyclic Shift Diversity (CSD) defined in 30.5.8.4.2.3 shall be used.

The symbol blocking structure for the EDMG-Header-B and data field of the MU non-FDMA PPDU for the short, normal and long GI shall be as shown in Figure 8, Figure 9, and Figure 10 respectively.



Figure 8: MU non-FDMA PPDU structure: EDMG-Header-B and data field symbol blocking, (2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, iSTS > 1), short GI



Figure 9: MU non-FDMA PPDU structure: EDMG-Header-B and data field symbol blocking, (2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, iSTS > 1), normal GI



Figure 10: MU non-FDMA PPDU structure: EDMG-Header-B and data field symbol blocking, (2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, iSTS > 1), long GI

The *NSTS* space-time streams of MU non-FDMA PPDU can be mapped to *NTX* (*NSTS* ≤ *NTX*) transmit chains applying direct, indirect spatial mapping or digital beamforming as defined in 30.5.8.4.2.1.

A TRN field per transmit chain (see 30.9.2.2.5) may be appended to a MU non-FDMA PPDU.

**30.5.7.2.5 MU FDMA PPDU transmission**

TBD

**SP:** Do you agree to accept the proposed comment resolution for CID 63 in 17/0893r1 and introduce the proposed changes into spec draft?

**References:**

1. Draft P802.11ay\_D0.35
2. IEEE802.11-2016