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Wireless LANs

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| CID Resolution – Part VIII | | | | |
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|  |  |  |  |  |

Abstract

This document proposes resolution for CIDs 1314, 2328, 1332, 2091, 1321, 2098, (6) [1].

Table 1: List of CIDs

|  |  |  |
| --- | --- | --- |
| **CID** | **Comment** | **Proposed resolution** |
| 1314 | "This subclause defines the waveform for the EDMG SC mode and the non-EDMG duplicate PPDU transmission over a 2.16 GHz, 4.32 GHz, 6.48 GHz, and 8.64 GHz channel using NTX transmit chains", This clause fails to indicate how are aggregate channels modulated (2.16+2.16, 4.32+4.32), in both SU and MU | Add a subclause for modulation for of the 2.16+2.16 and 4.32+4.32 case (both SU, and MU)  (Revised) |
| 1332 | "For transmissions over a 2.16 GHz, 4.32 GHz, 6.48 GHz and 8.64 GHz channel, the EDMG OFDM PHY" sequences for 2.16+2.16 and 4.32+4.32GHz are not define | Define OFDM TRN sequences for channel aggregations  (Revised) |
| 2091 | Unclear if CBW216+216 and CBW432+432 are allowed for EDMG OFDM mode. In some places, these channel bandwidths are not listed, but in other cases they are specifically listed | Add 2.16+2.16 GHz and 4.32+4.32 GHz to the list  (Revised) |
| 1321 | The waveform for channel aggregation (2.16+2.16 and 4.32+4.32 is not defined anywhere in this clause | Define how the channel aggregation modulation work  (Revised) |
| 2098 | Unclear if CBW216+216 and CBW432+432 are allowed for EDMG OFDM mode. In some places, these channel bandwidths are not listed, but in other cases they are specifically listed | Add 2.16+2.16 GHz and 4.32+4.32 GHz to the list  (Revised) |
| 2328 | The EDMG-CEF could also be shortened in case of Channel Aggregation similar to Table 87 | Redefine L2 and L4 for P\_EDMG\_CEF in the case of CA for N\_STS=4, 6, and 8  (Rejected) |

**CIDs 1314, 1332, 2091, 1321, 2098**

*Editor: introduce changes as below, p 238, line 1*

The EDMG portion of the EDMG format preamble enables estimation of the MIMO channel to support demodulation of the PSDU transmitted over 2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, and 4.32+4.32 GHz channels. The EDMG portion of the EDMG format preamble also includes the EDMG-Header-A field and may include EDMG-Header-B field.

*Editor: introduce changes as below, p 292, line 12*

Table 61 GIe definition for 2.16 GHz, 2.16+2.16 GHz (NCB = 1) channel

|  |  |  |  |
| --- | --- | --- | --- |
| Space-time stream number (*iSTS*) | Short GI | Normal GI | Long GI |
| 1 | GIe132 = -GA132 | GIe164 = +Ga164 | GIe1128 = -GA1128 |
| 2 | GIe232 = -GA232 | GIe264 = +Ga264 | GIe2128 = -GA2128 |
| 3 | GIe332 = -GA332 | GIe364 = +Ga364 | GIe3128 = -GA3128 |
| 4 | GIe432 = -GA432 | GIe464 = +Ga464 | GIe4128 = -GA4128 |
| 5 | GIe532 = -GA532 | GIe564 = +Ga564 | GIe5128 = -GA5128 |
| 6 | GIe632 = -GA632 | GIe664 = +Ga664 | GIe6128 = -GA6128 |
| 7 | GIe732 = -GA732 | GIe764 = +Ga764 | GIe7128 = -GA7128 |
| 8 | GIe832 = -GA832 | GIe864 = +Ga864 | GIe8128 = -GA8128 |

Table 62 —GIe definition for 4.32 GHz, 4.32+4.32 GHz (NCB = 2) channel

|  |  |  |  |
| --- | --- | --- | --- |
| Space-time stream number (*iSTS*) | Short GI | Normal GI | Long GI |
| 1 | GIe164 = -GA164 | GIe1128 = +Ga1128 | GIe1256 = +Ga1256 |
| 2 | GIe264 = -GA264 | GIe2128 = +Ga2128 | GIe2256 = +Ga2256 |
| 3 | GIe364 = +GA364 | GIe3128 = +Ga3128 | GIe3256 = +Ga3256 |
| 4 | GIe464 = +GA464 | GIe4128 = +Ga4128 | GIe4256 = +Ga4256 |
| 5 | GIe564 = +GA564 | GIe5128 = +Ga5128 | GIe5256 = +Ga5256 |
| 6 | GIe664 = +GA664 | GIe6128 = +Ga6128 | GIe6256 = +Ga6256 |
| 7 | GIe764 = -GA764 | GIe7128 = +Ga7128 | GIe7256 = +Ga7256 |
| 8 | GIe864 = -GA864 | GIe8128 = +Ga8128 | GIe8256 = +Ga8256 |

*Editor: introduce changes in 30.5.9.2 as below, p 293, line 5*

* + - 1. Symbol blocking and guard insertion
         1. General

This subclause defines the symbol blocking and guard interval structure for each type of EDMG SC mode PPDU. The GIs used to define symbol blocking structure for the pre-EDMG fields, EDMG-Header-B and Data field are defined in 30.5.9.1.

The symbol notations for frequently used parameters in this subclause are summarized in Table 65.

Table 65 — 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 the PPDU transmission, 1 ≤ *NCB* ≤ 4 |
| *iPPDU* | PPDU index number aggregated into the A-PPDU, 1 ≤ *iPPDU* ≤ *NPPDU* |
| *NPPDU* | Total number of PPDUs aggregated into a single A-PPDU |

The SU PPDU symbol blocking and guard interval structure shall be as defined in 30.5.9.2.2. The SU A-PPDU symbol blocking and guard interval structure shall be as defined in 30.5.9.2.3.

The MU PPDU symbol blocking and guard interval structure shall be as defined in 30.5.9.2.4.

* + - * 1. SU PPDU transmission

General

This subclause defines a SU PPDU transmission 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 one or more space-time streams.

The SU PPDU structure for a 2.16 GHz PPDU transmission and a single space-time stream transmission (*NSTS* = 1) shall be as defined in 30.5.9.2.2.2. The SU PPDU structure for a 2.16 GHz and 2.16+2.16 GHz PPDU transmission with more than one space-time streams (*NSTS* > 1) and 4.32 GHz, 6.48 GHz, 8.64 GHz, 4.32+4.32 GHz PPDU transmissions with one or more space-time streams (*NSTS* ≥ 1) shall be as defined in 30.5.9.2.2.3.

SU PPDU transmission over a 2.16 GHz and 2.16+2.16 GHz channel with *NSTS* = 1

An SU PPDU transmitted over a 2.16 GHz and 2.16+2.16 GHz channel with a single space-time stream (*NSTS* = 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 the symbol blocking structure of the pre-EDMG fields.

The EDMG SC mode SU PPDU symbol blocking structure for the short, normal and long GI shall be as shown in Figure 131, Figure 132, and Figure 133, respectively. An EDMG STA shall support the SU PPDU structure with normal GI as shown in Figure 132.



Figure 131—SU PPDU structure: 2.16 GHz and 2.16+2.16 GHz channel, *NSTS* = 1, short GI



Figure 132—SU PPDU structure: 2.16 GHz and 2.16+2.16 GHz channel, *NSTS* = 1, normal GI



Figure 133—SU PPDU structure: 2.16 GHz and 2.16+2.16 GHz channel, *NSTS* = 1, long GI

The single space-time stream of an SU PPDU may be mapped to *NTX* ≥ 1 transmit chains applying direct, indirect spatial mapping or digital beamforming as defined in 30.5.10.4.1. The single space-time stream may be mapped to *NTX* ≥ 1 transmit chains applying spatial expansion as defined in 30.5.10.4.2.

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

SU PPDU transmission over a 2.16 GHz and 2.16+2.16 GHz channel with *NSTS* > 1 and over a 4.32 GHz, 6.48 GHz, 8.64 GHz and 4.32+4.32 GHz channel with *NSTS* ≥ 1

An SU PPDU transmitted over a 2.16 GHz and 2.16+2.16 GHz channel with more than one space-time stream (*NSTS* > 1) and an SU PPDU transmission over a 4.32 GHz, 6.48 GHz, 8.64 GHz, and 4.32+4.32 GHz channel with one or more space-time streams (*NSTS* ≥ 1) shall be defined at the *NCB*×1.76 GHz sampling rate.

A 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 and 2.16+2.16 GHz channel shall be defined at the SC chip rate equal to 1.76 GHz as shown in Figure 134.



Figure134—SU PPDU structure: pre-EDMG fields symbol blocking, 2.16 GHz and 2.16+2.16 GHz channel

To transmit pre-EDMG fields over a 4.32 GHz, 6.48 GHz, 8.64 GHz, and 4.32+4.32 GHz channel, the duplicate format defined in 30.5.10.4.2 shall be used.

To transmit pre-EDMG fields using *NTX* > 1 transmit chains, the format using cyclic shift diversity (CSD) defined in 30.5.10.4.2 shall be used.

The symbol blocking structure for the Data field of a SU PPDU for the short, normal and long GI shall be as shown in Figure 135, Figure 136 and Figure 137, respectively.



Figure135—SU PPDU structure: Data field symbol blocking, (2.16 GHz, 2.16+2.16 GHz *NSTS* > 1) or (4.32 GHz, 6.48 GHz, 8.64 GHz, 4.32+4.32 GHz *NSTS* ≥ 1), short GI



Figure136—SU PPDU structure: Data field symbol blocking, (2.16 GHz, 2.16+2.16 GHz *NSTS* > 1) or (4.32 GHz, 6.48 GHz, 8.64 GHz, 4.32+4.32 GHz *NSTS* ≥ 1), normal GI



Figure137—SU PPDU structure: Data field symbol blocking, (2.16 GHz, 2.16+2.16 GHz *NSTS* > 1) or (4.32 GHz, 6.48 GHz, 8.64 GHz, 4.32+4.32 GHz *NSTS* ≥ 1), long GI

The *NSTS* space-time streams of an SU PPDU may be mapped to *NTX* (*NSTS* ≤ *NTX*) transmit chains applying direct, indirect spatial mapping or digital beamforming as defined in 30.5.10.4.1. The single space-time stream may be mapped to *NTX* ≥ 1 transmit chains applying spatial expansion as defined in 30.5.10.4.2.

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

* + - * 1. SU A-PPDU transmission

The SU PPDU structures for EDMG A-PPDU transmission described in this subclause cover all the combination of channel bandwidth and number of spatial streams.

The SU PPDU structures for the first EDMG PPDU (i.e., *iPPDU*= 1) within the EDMG A-PPDU are as shown in Figure 131 through Figure 137. The SU PPDU structure for the EDMG PPDUs following the first EDMG PPDU (i.e., 2 ≤ *iPPDU* ≤ *NPPDU*) when using the short GI, normal GI and long GI shall be as shown in Figure 138, Figure 139, and Figure 140, respectively. The final block transmitted of each EDMG PPDU within the EDMG A-PPDU is followed by the same GI as the Data field regardless of the value of the Additional EDMG PPDU field within the EDMG-Header-A.



Figure 138—SU PPDU structure: EDMG A-PPDU, 2 ≤ *iPPDU* ≤ *NPPDU*, short GI



Figure 139—SU PPDU structure: EDMG A-PPDU, 1 ≤ *iPPDU* ≤ *NPPDU*, normal GI



Figure 140—SU PPDU structure: EDMG A-PPDU, 1 ≤ *iPPDU* ≤ *NPPDU*, long GI

* + - * 1. MU PPDU transmission

General

This subclause defines a MU PPDU transmission 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 one or more space-time streams transmitted to two or more users (*Nuser* > 1).

An MU PPDU transmission shall be as defined in 30.5.9.2.4.2.

MU PPDU transmission

This subclause defines an MU PPDU transmission 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 more than one space-time stream (*NSTS* > 1) allocated for two or more users (*Nuser* > 1).

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

The symbol blocking structure for pre-EDMG fields transmitted over a 2.16 GHz and 2.16+2.16 GHz channel shall be defined at the SC chip rate equal to 1.76 GHz as shown in Figure 134.

To transmit pre-EDMG fields over a 4.32 GHz, 6.48 GHz, 8.64 GHz, and 4.32+4.32 GHz channel, the duplicate format defined in 30.5.10.4.2 shall be used.

To transmit pre-EDMG fields using *NTX* > 1 transmit chains, the format using cyclic shift diversity (CSD) defined in 30.5.10.4.2 shall be used.

The symbol blocking structure for the EDMG-Header-B and Data field of an MU PPDU for the short, normal and long GI shall be as shown in Figure 141, Figure 142 and Figure 143, respectively.



Figure 141—MU PPDU structure: EDMG-Header-B and Data field symbol blocking, (2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, 4.32+4.32 GHz *NSTS* > 1), short GI



Figure 142—MU PPDU structure: EDMG-Header-B and Data field symbol blocking, (2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, 4.32+4.32 GHz, *NSTS* > 1), normal GI



Figure 143—MU PPDU structure: EDMG-Header-B and Data field symbol blocking, (2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, 4.32+4.32 GHz *NSTS* > 1), long GI

The *NSTS* space-time streams of an MU PPDU may be mapped to *NTX* (*NSTS* ≤ *NTX*) transmit chains applying direct, indirect spatial mapping or digital beamforming as defined in 30.5.10.4.1.

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

*Editor: introduce changes in 30.5.10 as below, p 312, line 4*

* + 1. PPDU transmission

30.5.10.1 General

This subclause defines the waveform for the EDMG SC mode and the non-EDMG PPDU transmission over a 2.16 GHz, 4.32 GHz, 6.48 GHz, and 8.64 GHz, 2.16+2.16 GHz, and 4.32+4.32 GHz channel using *NTX* transmit chains.

The definition of the spatial mapping methods is provided in 30.5.10.2. The non-EDMG PPDU transmission shall be as defined in 30.5.10.3. The EDMG SU PPDU transmission shall be as defined in 30.5.10.4. The EDMG MU PPDU transmission shall be as defined in 30.5.10.5.

The frequently used symbol notations in this subclause are summarized in Table 70.

Table 70—Frequently used parameters

|  |  |
| --- | --- |
| **Symbol** | **Explanation** |
|  | Space-time stream number |
|  | Total number of space-time streams over all users |
|  | User number |
|  | Total number of users |
|  | Transmit chain number |
|  | Total number of transmit chains |
|  | SC chip rate, equal to 1.76 GHz |
|  | SC chip time duration, equal to 1/*Fc* |
|  | Number of contiguous 2.16 GHz channels used for PPDU transmission, 1 ≤ *NCB* ≤ 4 |
|  | Spatial mapping matrix of size *NTX* by *NSTS* |
|  | Up-sampling parameter |
|  | Total number of PPDUs into EDMG A-PPDU |

* + - 1. Spatial mapping

Spatial mapping defines the method of *NSTS* space-time streams to *NTX* transmit chains mapping, where *NSTS* ≤ *NTX*, which may be implemented by means of a spatial mapping matrix Q of size *NTX* by *NSTS* or by cyclic shift diversity (CSD). The spatial mapping matrix Q is independent of the chip time index or subcarrier index and is constant in time.

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

* Direct mapping, *NSTS* = *NTX*: the spatial mapping matrix Q is a square diagonal complex values matrix of size *NTX* that might be defined as follows:
* , the identity matrix
* , exponential matrix
* 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:
* Q = F, the discrete Fourier matrix
* Q = H, the normalized Hadamard matrix
* 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 between beamformer and beamformee.
* Spatial expansion, *NSTS* = 1 < *NTX*: the spatial expansion is performed by the application of CSD over different transmit chains. The CSD is applied to the fields of PPDU with the exception of the TRN field. This enables duplication of the transmission of PPDU fields over the *NTX* transmit chains and avoids unintentional beamforming that exists with a coherent signal transmission. The spatial expansion technique is not applied to the TRN field, which is transmitted using an orthogonal sequence set.
  + - 1. Non-EDMG PPDU transmission
         1. Non-EDMG PPDU transmission over a 2.16 GHz and 2.16+2.16 GHz channel

The non-EDMG PPDU waveform shall be defined at the SC chip rate equal to 1.76 GHz and include the following modulated fields:



where:

 is the duration of the L-STF field of the PPDU

 is the total duration of the L-STF and L-CEF fields of the PPDU

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

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

In the non-EDMG duplicate PPDU waveform, the AGC and TRN fields may be present in a 2.16 GHz non-EDMG PPDU transmission and shall not be present in a 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, or 4.32+4.32 GHz non-EDMG PPDU transmission.

Unless specified, the chip index *n* is defined in the range [0, *NField* - 1], where *NField* defines the total number of samples for a given signal field. The definition of the L-STF, L-CEF, and L-Header fields is provided in 30.3.3.2.2, 30.3.3.2.3, and 30.3.3.2.4, respectively. The definition of the AGC and TRN fields is provided in 20.10.2.2.5 and 20.10.2.2.6, respectively. The L-Header and Data fields encoding and modulation is provided in 20.6.3.1.4 and 20.6.3.2, respectively.

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



where:

 is a spatial mapping matrix

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

In case of spatial expansion, the non-EDMG waveform for the *iTXth* transmit chain includes a cyclic shift, , dependent on the particular transmit chain number. The cyclic shift, , is defined in SC chip units as (*iTX* – 1)×*Nc*×*Tc*, where *Nc* is equal to 4 chips and *Tc* is a chip time duration.



where:



The non-EDMG waveform for the *iTXth* transmit chain is obtained by up-sampling and filtering and then appropriate carrier frequency shift of the  waveform, if required. The up-sampling procedure is applied using a factor of *Nup*. The filtering procedure is performed with a pulse shaping filter defined at the *Nup*×1.76 GHz sampling rate as follows:



where:

 is the length of  in samples



The non-EDMG waveform for the *iTXth* transmit chain when transmitted over a 2.16 GHz or 2.16+2.16 GHz channel shall be defined as:



For 2.16+2.16 GHz transmission, the total number of transmit chains, *NTX*, shall be an even number. The first *NTX*/2 transmit chains shall be used for transmission on the primary channel and the second *NTX*/2 transmit chains shall be used for transmission on the secondary channel (see 30.3.4).

* + - * 1. Non-EDMG duplicate PPDU transmission over a 4.32 GHz, 6.48 GHz, 8.64 GHz, and 4.32+4.32 GHz channel

The non-EDMG waveform for the *iTXth* transmit chain when transmitted using duplicate transmission over a 4.32 GHz or 4.32+4.32 GHz channel shall be defined as:



where:

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

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

Delay equal to 0 corresponds to the primary channel

For 4.32+4.32 GHz transmission, the total number of transmit chains, *NTX*, shall be an even number. The first *NTX*/2 transmit chains shall be used for transmission on the primary and secondary channels and the second *NTX*/2 transmit chains shall be used for transmission on the secondary1 and secondary2 channels (see 30.3.4).

The non-EDMG waveform for the *iTXth* transmit chain when transmitted using duplicate transmission over a 6.48 GHz channel shall be defined as:



where:

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

Delay equal to 0 corresponds to the primary channel

The non-EDMG waveform for the *iTXth* transmit chain when transmitted using duplicate transmission over a 8.64 GHz channel shall be defined as:



where:

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

Delay equal to 0 corresponds to the primary channel

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

* + - 1. EDMG SU PPDU transmission
         1. EDMG PPDU transmission over a 2.16 GHz and 2.16+2.16 GHz channel with *NSTS* = 1

An EDMG SC mode SU PPDU transmitted over a 2.16 GHz or 2.16+2.16 GHz channel with single space-time stream (*NSTS* = 1) is composed of pre-EDMG, Data and TRN fields. The total number of transmit chains, *NTX*, shall be constant over the different fields of the PPDU.

For a single PPDU transmission, the pre-EDMG and Data fields include the following modulated fields:



where:

 is the duration of the L-STF field of the PPDU

 is the total duration of the L-STF and L-CEF fields of the PPDU

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

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

The definition of the L-STF, L-CEF, and L-Header fields is provided in 30.3.3.2.2, 30.3.3.2.3, and30.3.3.2.4, respectively.

For an EDMG A-PPDU transmission of *NPPDU* PPDUs, the pre-EDMG, the EDMG modulated field of the EDMG preamble, and Data fields include the following modulated fields:



where:

 is the duration of L-STF field of the PPDU

 is the total duration of L-STF and L-CEF fields of the PPDU

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

 is the total duration of L-STF, L-CEF, L-Header, and EDMG-Header-A1 fields of the PPDU

 is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, and Data1 fields of the PPDU

 is is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, Data1, and EDMG-Header-A2 fields of the PPDU

…

 is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, Data1, EDMG-Header-A2, Data2, …, and DataNPPDU – 1 fields of the PPDU

 is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, Data1, EDMG-Header-A2, Data2, …, DataNPPDU – 1, and EDMG-Header-ANPPDU fields of the PPDU

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:



where:

 is a spatial mapping matrix

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

In case of spatial expansion, the PPDU waveform of the pre-EDMG and Data fields for the *iTXth* transmit chain includes a cyclic shift, , dependent on the particular transmit chain number. The cyclic shift, , is defined in SC chip units as (*iTX* – 1)×*Nc*×*Tc*, where *Nc* is equal to 4 chips and *Tc* is a chip time duration.



where:



The TRN field, , shall be defined at the SC chip rate equal to 1.76 GHz per *iTXth* transmit chain as defined in 30.9.2.2.5.

The resulting SU PPDU waveform for a 2.16 GHz or 2.16+2.16 GHz channel and single space-time stream (*NSTS* = 1) for the *iTXth* transmit chain concatenates the preamble and Data fields with the TRN field and shall be defined as:



where:

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

For 2.16+2.16 GHz transmission, the total number of transmit chains, *NTX*, shall be an even number. The first *NTX*/2 transmit chains shall be used for transmission on the primary channel and the second *NTX*/2 transmit chains shall be used for transmission on the secondary channel (see 30.3.4).

The filtering procedure is performed with a pulse shaping filter, , defined at the *Nup*×1.76 GHz sampling rate as follows:



where:

 is the length of  in samples



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

* + - * 1. EDMG PPDU transmission with DMG AGC and TRN fields over a 2.16 GHz channel with *NSTS* = 1

For a special case of a DMG AGC and TRN fields’ transmission over a 2.16 GHz channel, indicated by the DMG TRN field in the EDMG-Header-A, the EDMG SU PPDU is transmitted with a single space-time stream and composed of a pre-EDMG, Data field and DMG AGC and TRN fields.

For a single PPDU transmission, the pre-EDMG, Data, and AGC and TRN fields include the following modulated fields:



where:

 is the duration of the L-STF field of the PPDU

 is the total duration of the L-STF and L-CEF fields of the PPDU

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

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

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

The definition of the L-STF, L-CEF, and L-Header fields is provided in 30.3.3.2.2, 30.3.3.2.3, and 30.3.3.2.4, respectively. The definition of the AGC and TRN fields is provided in 20.10.2.2.5 and 20.10.2.2.6, respectively.

For an EDMG A-PPDU transmission of *NPPDU* PPDUs, the pre-EDMG, the EDMG modulated field of the EDMG preamble, Data and AGC and TRN fields include the following modulated fields:



where:

 is the duration of L-STF field of the PPDU

 is the total duration of L-STF and L-CEF fields of the PPDU

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

 is the total duration of L-STF, L-CEF, L-Header, and EDMG-Header-A1 fields of the PPDU

 is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, and Data1 fields of the PPDU

 is is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, Data1, and EDMG-Header-A2 fields of the PPDU

…

 is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, Data1, EDMG-Header-A2, Data2, …, and DataNPPDU – 1 fields of the PPDU

 is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, Data1, EDMG-Header-A2, Data2, …, DataNPPDU – 1, and EDMG-Header-ANPPDU fields of the PPDU

 is the total duration of L-STF, L-CEF, L-Header, EDMG-Header-A1, Data1, EDMG-Header-A2, Data2, …, DataNPPDU – 1, EDMG-Header-ANPPDU, and DataNPPDU fields of the PPDU

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



where:

 is a spatial mapping matrix

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

In case of spatial expansion, the EDMG PPDU waveform for the *iTXth* transmit chain includes a cyclic shift, , dependent on the particular transmit chain number. The cyclic shift, , is defined in SC chip units as (*iTX* – 1)×*Nc*×*Tc*, where *Nc* is equal to 4 chips and *Tc* is a chip time duration:



where:

 is the total number of chips in the pre-EDMG, Data, and AGC and TRN fields

The filtering procedure is performed with a pulse shaping filter, , defined at the *Nup*×1.76 GHz sampling rate as follows:



where:

 is the length of  in samples



 is the total number of chips in the EDMG PPDU waveform

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

* + - * 1. EDMG PPDU transmission over a 2.16 GHz and 2.16+2.16 GHz channel with *NSTS* > 1 and 4.32 GHz, 6.48 GHz, 8.64 GHz, and 4.32+4.32 GHz channel with *NSTS* ≥ 1

General

An EDMG SC mode SU PPDU transmitted over a 2.16 GHz or 2.16+2.16 GHz channel with more than one stream (*NSTS* > 1) or over a 4.32 GHz, 6.48 GHz, 8.64 GHz, or 4.32+4.32 GHz channels with one or more space-time streams (*NSTS* ≥ 1) is composed of pre-EDMG fields, EDMG preamble, Data field and TRN field. The total number of transmit chains, *NTX*, shall be constant over the different fields of the EDMG SU PPDU.

Pre-EDMG fields transmission

The pre-EDMG fields of the PPDU includes the following modulated fields:



where:

 is the duration of the L-STF field of the PPDU

 is the total duration of the L-STF and L-CEF fields of the PPDU

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

The definition of the L-STF, L-CEF, and L-Header fields is provided in 30.3.3.2.2, 30.3.3.2.3, and 30.3.3.2.4, respectively.

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



where:

 is a spatial mapping matrix

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

In case of spatial expansion, the PPDU waveform of the pre-EDMG fields for the *iTXth* transmit chain includes a cyclic shift, , dependent on the particular transmit chain number. The cyclic shift, , is defined in SC chip units as (*iTX* – 1)×*Nc*×*Tc*, where *Nc* is equal to 4 chips and *Tc* is a chip time duration.



where:



The waveform for the pre-EDMG fields for *iTXth* transmit chain is obtained by up-sampling and filtering and then appropriate carrier frequency shift of the  waveform, if required. The up-sampling procedure is applied using a factor of *Nup*. The filtering procedure is performed with a pulse shaping filter defined at the *Nup*×1.76 GHz sampling rate as:



where:

 is the length of  in samples



The waveform of the pre-EDMG fields for the *iTXth* transmit chain when transmitted over a 2.16 GHz or 2.16+2.16 GHz channel shall be defined as:



For 2.16+2.16 GHz transmission, the total number of transmit chains, *NTX*, shall be an even number. The first *NTX*/2 transmit chains shall be used for transmission on the primary channel and the second *NTX*/2 transmit chains shall be used for transmission on the secondary channel (see 30.3.4).

The waveform of the pre-EDMG fields for the *iTXth* transmit chain when transmitted using duplicate transmission over a 4.32 GHz or 4.32+4.32 GHz channel shall be defined as:



where:

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

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

Delay equal to 0 corresponds to the primary channel

For 4.32+4.32 GHz transmission, the total number of transmit chains, *NTX*, shall be an even number. The first *NTX*/2 transmit chains shall be used for transmission on the primary and secondary channels and the second *NTX*/2 transmit chains shall be used for transmission on the secondary1 and secondary2 channels (see 30.3.4).

The waveform of the pre-EDMG fields for the *iTXth* transmit chain when transmitted using duplicate transmission over a 6.48 GHz channel shall be defined as:



where:

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

Delay equal to 0 corresponds to the primary channel

The waveform of the pre-EDMG fields for the *iTXth* transmit chain when transmitted using duplicate transmission over a 8.64 GHz channel shall be defined as:



where:

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

Delay equal to 0 corresponds to the primary channel

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

EDMG preamble and Data fields transmission

For a single PPDU transmission, the EDMG modulated field of the EDMG preamble and Data field of an SU PPDU is defined for the *iSTSth* space-time stream at the *NCB*×1.76 GHz chip rate and includes the following modulated fields:



where:

 is the duration of the EDMG-STF field of the PPDU

 is the total duration of the EDMG-STF and EDMG-CEF fields of the PPDU

For an EDMG A-PPDU transmission of *NPPDU* PPDUs, the EDMG modulated field of the EDMG preamble and Data field of an SU PPDU is defined for *iSTS*th space-time stream at the *NCB* × 1.76 GHz chip rate and includes the following modulated fields:



where:

 is the duration of EDMG-STF field of the PPDU

 is the total duration of EDMG-STF and EDMG-CEF fields of the PPDU

 is the total duration of EDMG-STF, EDMG-CEF, and Data1 fields of the PPDU

 is the total duration of EDMG-STF, EDMG-CEF, Data1, and EDMG-Header-A2 fields of the PPDU

…

 is the total duration of EDMG-STF, EDMG-CEF, Data1, EDMG-Header-A2, Data2, …, and DataNPPDU – 1 fields of the PPDU

 is the total duration of EDMG-STF, EDMG-CEF, Data1, EDMG-Header-A2, Data2, …, DataNPPDU – 1, and EDMG-Header-ANPPDU fields of the PPDU

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



where:

 is a total number of space-time streams

 is a spatial mapping matrix

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

In case of spatial expansion, the PPDU waveform of the EDMG preamble and Data field for the *iTXth* transmit chain includes a cyclic shift, , dependent on the particular transmit chain number. The cyclic shift, , is defined in SC chip units as (*iTX* – 1)×*Nc*×*Tc*, where *Nc* is equal to 4 chips and *Tc* is a chip time duration.



where:



TRN field transmission

The TRN field, , shall be defined at the SC chip rate equal to *NCB*×1.76 GHz per *iTXth* transmit chain as defined in 30.9.2.2.5.

Filtering procedure

The EDMG preamble, Data field, and TRN field for the *iTXth* transmit chain are defined as:



where:

 is the total duration of the EDMG-STF, EDMG-CEF, and Data fields of the PPDU

The EDMG preamble, Data field and TRN field are filtered and resampled with a conversion rate ratio *Nup*/*NCB*. For example, the resampling procedure for a ratio *Nup*/*NCB* equal to 3/2 can be defined as follows:



where:

 is the length of  in samples



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, EDMG-Header-A, EDMG-STF, EDMG-CEF, and Data fields of the PPDU

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

EDMG MU PPDU transmission

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, or 4.32+4.32 GHz channel with multiple space-time streams (*NSTS* > 1) for two or more users (*Nuser* > 1) is composed of pre-EDMG fields, EDMG preamble, EDMG-Header-B field, Data field and TRN field. The total number of transmit chains, *NTX*, shall be constant over the different fields of an EDMG MU PPDU.

Pre-EDMG fields transmission

The pre-EDMG fields of the PPDU shall be transmitted as specified in 30.5.10.4.2.2.

EDMG preamble, EDMG-Header-B and Data fields transmission

The EDMG preamble, EDMG-Header-B and Data field of an EDMG MU PPDU is defined for *iSTSth* space-time stream at the *NCB*×1.76 GHz chip rate and includes the following modulated fields:



where:

is the duration of the EDMG-STF field of the PPDU

 is the total duration of the EDMG-STF and EDMG-CEF fields of the PPDU

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

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



where:

 is a total number of space-time streams

 is a spatial mapping matrix

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

TRN field transmission

The TRN field, , shall be defined at the SC chip rate equal to *NCB*×1.76 GHz per *iTXth* transmit chain as defined in 30.9.2.2.5.

Filtering procedure

The EDMG preamble, EDMG-Header-B, Data field, and TRN field for the *iTXth* transmit chain are defined as:



where:

 is the total duration of the EDMG-STF, EDMG-CEF, EDMG-Header-B and Data fields of the PPDU

The EDMG preamble, EDMG-Header-B, Data field and TRN field are filtered and resampled with a conversion rate ratio *Nup*/*NCB*. For example, the resampling procedure for a ratio *Nup*/*NCB* equal to 3/2 can be defined as follows:

 where:

 is the length of  in samples



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, EDMG-Header-A, EDMG-STF, EDMG-CEF, EDMG-Header-B, and Data fields of the PPDU

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

*Editor: introduce changes in 30.6.9 as below, p 362, line 22*

* + 1. PPDU transmission
       1. General

This subclause defines the waveform for an EDMG OFDM mode PPDU transmission 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 using *NTX* transmit chains.

The spatial mapping methods are defined in 30.6.9.2. The EDMG SU PPDU transmission shall be as defined in 30.6.9.3. The EDMG MU PPDU transmission shall be as defined in 30.6.9.4.

The symbol notations used in this subclause are summarized in Table 84.

Table 84— Frequently used parameters

|  |  |
| --- | --- |
| Symbol | Explanation |
|  | Space-time stream number |
|  | Total number of space-time streams over all users |
|  | User number |
|  | Total number of users |
|  | Transmit chain number |
|  | Total number of transmit chains |
|  | SC chip rate, equal to 1.76 GHz |
|  | SC chip time duration, equal to 1/*Fc* |
|  | OFDM sampling rate equal to *NCB*×2.64 GHz |
|  | OFDM sample time duration, equal to 1/*Fs* |
|  | Number of contiguous 2.16 GHz channels used for PPDU transmission, 1 ≤ *NCB* ≤ 4 |
|  | Spatial mapping matrix of size *NTX* by *NSTS*, defined for *k*-th subcarrier |
|  | Up-sampling parameter |
|  | Total number of PPDUs into EDMG A-PPDU |

* + - 1. Spatial mapping

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 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:
* Qk = F, the discrete Fourier matrix
* Qk = H, the normalized Hadamard matrix
* Digital 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.
  + - 1. EDMG SU PPDU transmission
         1. General

An EDMG OFDM mode SU PPDU transmitted over a 2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz, or 4.32+4.32 GHz channel with single and multiple space-time streams (1 ≤ *iSTS* ≤ *NSTS*) is composed of pre-EDMG, EDMG preamble, Data field and TRN field.

The pre-EDMG fields of the EDMG PPDU include the L-STF, L-CEF, L-Header, and EDMG-Header-A and shall be transmitted using SC modulation as defined in 30.5.10.4.2.2. The EDMG-STF, EDMG-CEF, Data field, and TRN field shall be transmitted using OFDM modulation as defined in 30.6.3, 30.6.4, 30.6.8, and 30.9.2.2.5, respectively.

The total number of transmit chains, *NTX*, shall be constant over the different fields of a transmitted EDMG SU PPDU.

* + - * 1. Pre-EDMG fields transmission

See 30.5.10.4.2.2.

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×1.76 GHz sampling rate, where Nup = (3/2)×NCB.

* + - * 1. EDMG preamble, Data and TRN fields transmission

For a single PPDU transmission, the EDMG modulated field of the EDMG preamble, Data field and TRN field of an SU PPDU is defined for the *iTX*th transmit chain at the *Fs* = *NCB*×2.64 GHz sampling rate, where sample time duration *Ts* = 1/*Fs*, and includes the following modulated fields:



where:

 is the duration of the EDMG-STF field of the PPDU

 is the total duration of the EDMG-STF and the EDMG-CEF fields of the PPDU

 is the total duration of the EDMG-STF, the EDMG-CEF, and Data fields of the PPDU

For an EDMG A-PPDU transmission of *NPPDU* PPDUs, the EDMG modulated field of the EDMG preamble, Data and TRN fields of an SU PPDU is defined for *iTX*th transmit chain at the *Fs* = *NCB*×2.64 GHz sampling rate, sample time duration *Ts* = 1/*Fs*, and includes the following modulated fields:



where:

 is the duration of EDMG-STF field of the PPDU

 is the total duration of EDMG-STF and EDMG-CEF fields of the PPDU

 is the total duration of EDMG-STF, EDMG-CEF, and Data1 fields of the PPDU

 is the total duration of EDMG-STF, EDMG-CEF, Data1, and EDMG-Header-A2 fields of the PPDU

…

 is the total duration of EDMG-STF, EDMG-CEF, Data1, EDMG-Header-A2, Data2, …, and DataNPPDU – 1 fields of the PPDU

 is the total duration of EDMG-STF, EDMG-CEF, Data1, EDMG-Header-A2, Data2, …, DataNPPDU – 1, and EDMG-Header-ANPPDU fields of the PPDU

 is the total duration of EDMG-STF, EDMG-CEF, Data1, EDMG-Header-A2, Data2, …, DataNPPDU-1, EDMG-Header-ANPPDU, and DataNPPDU fields of the PPDU

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



where:

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

The definition of the pulse shaping filter impulse response, , used for the transmission of the pre-EDMG fields is implementation specific and out of scope of this standard.

* + - 1. EDMG MU PPDU transmission
         1. General

An EDMG OFDM mode MU PPDU transmission over a 2.16 GHz, 4.32 GHz, 6.48 GHz, 8.64 GHz, 2.16+2.16 GHz channel with single and multiple space-time streams (1 ≤ *iSTS* ≤ *NSTS*) is composed of pre-EDMG, EDMG preamble, Data field and TRN field.

The pre-EDMG fields of the PPDU include the L-STF, L-CEF, L-Header, and EDMG-Header-A and shall be transmitted using SC modulation as defined in 30.5.10.4.2.2. The EDMG-STF, EDMG-CEF, EDMG-Header-B, Data field, and TRN field shall be transmitted using OFDM modulation as defined in 30.6.3, 30.6.4, 30.6.5, 30.6.8, and 30.9.2.2.5, respectively.

The total number of transmit chains, *NTX*, shall be constant over the different fields of a transmitted EDMG MU PPDU.

* + - * 1. Pre-EDMG fields transmission

See 30.5.10.4.2.2.

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×1.76 GHz sampling rate, where Nup = (3/2)×NCB.

* + - * 1. EDMG preamble, Data and TRN fields transmission

The EDMG preamble, Data field and TRN field of an MU PPDU is defined for the *iTX*th transmit chain at the *Fs* = *NCB*×2.64 GHz sampling rate, where sample time duration *Ts* = 1/*Fs*, and includes the following modulated fields:



where:

 is the duration of the EDMG-STF field of the PPDU

 is the total duration of EDMG-STF and EDMG-CEF fields of the PPDU

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

 is the total duration of the EDMG-STF, EDMG-CEF, EDMG-Header-B, and Data fields of the PPDU

The Data field of an MU PPDU shall be modulated using  OFDM symbols for the iuserth user as defined in 30.6.8.

The EDMG OFDM mode MU PPDU waveform for the *iTX*th transmit chain concatenates the pre-EDMG, EDMG preamble, Data field and TRN field and shall be defined as follows:



where:

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

The definition of the pulse shaping filter impulse response, , used for the transmission of the pre-EDMG fields is implementation specific and out of scope of this standard.

*Editor: introduce changes in 30.9.2.2.7 as below, p 388, line 6*

* + - * 1. TRN subfield definition for EDMG OFDM PPDUs

For EDMG PPDU transmissions using the EDMG OFDM mode over a 2.16 GHz or 2.16+2.16 GHz channel, the OFDM TRN\_BASIC sequence is defined in frequency domain for the *iTXth* transmit chain as follows:

* TRN\_BASICiTX-177, 177 = [SeqiTXleft, 176, 0, 0, 0, SeqiTXright, 176], for *iTX* =1, 2, 3, 4, 5, 6, 7, 8

For EDMG PPDU transmissions using the EDMG OFDM mode over a 4.32 GHz or 4.32+4.32 GHz channel, the OFDM TRN\_BASIC sequence is defined in frequency domain for the *iTXth* transmit chain as follows:

* TRN\_BASICiTX-386, 386 = [SeqiTXleft, 385, 0, 0, 0, SeqiTXright, 385], for *iTX* =1, 2, 3, 4, 5, 6, 7, 8

*Editor: introduce changes in 30.11 as below, p 442, line 2*

* 1. OFDM sequences
     1. EDMG-STF sequence
        1. General

For transmissions over a 2.16 GHz (or 2.16+2.16 GHz), 4.32 GHz (or 4.32+4.32 GHz), 6.48 GHz and 8.64 GHz channel, the EDMG OFDM mode uses the pairs of and sequences (*iSTS* = 1, 2, …, 8) with length *N* = 176, 385, 595, and 804, respectively, to define the EDMG-STF field in frequency domain.

* + - 1. Sequence definition

The sequence pairs and  of length *N* = 176, 385, 595, and 804 use {±1, ±j} symbols alphabet and are defined in Table 115 through Table 122.

*Editor: introduce changes in 30.12 as below, p 462, line 2*

* + 1. EDMG-CEF sequence
       1. General

For transmissions over a 2.16 GHz (or 2.16+2.16 GHz), 4.32 GHz (or 4.32+4.32 GHz), 6.48 GHz and 8.64 GHz channel, the EDMG OFDM mode uses the pairs of *Seqileft,N* and *Seqiright,N* sequences of length *N* = 176, 385, 595, and 804, respectively, to define the EDMG-CEF field in frequency domain. The *ith* index defines the space-time stream or the transmit chain number.

* + - 1. Sequences definition

The sequence pairs *Seqileft,N* and *Seqiright,N* of length *N* = 176, 385, 595, and 804 use {±1, ±j} symbols alphabet and are defined in Table 123 through Table 130.

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*Comment:*

The EDMG-CEF could also be shortened in case of Channel Aggregation similar to Table 87

*Proposed resolution:*

Redefine L2 and L4 for P\_EDMG\_CEF in the case of CA for N\_STS=4, 6, and 8

*Discussion:*

In the D1.0 the mapping of spatial streams to the channels was defined.

Afterwards, it was decided to map transmit chains to the different 2.16 GHz channels in case of channel aggregation. The user can map the NSTS to NTX in a different way and not limited in that sense. So the proposal is obsolete.

*Resolution:*

Rejected

**SP:**

Do you agree to accept the proposed resolutions for CIDs 1314, 2328, 1332, 2091, 1321, 2098 in (11-18-0639-00-00ay CID Resolution - Part VIII)?

**References:**

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