­IEEE P802.11
Wireless LANs

|  |
| --- |
| PHY section editorial comments on D0.4 |
| Date: 2016-08-30 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Sungeun Lee | Cypress Semiconductor Corporation | 90 Matawan Rd Matawan NJ 07747 |  | sule at cypress.com |
| Kai Xie | Cypress Semiconductor Corporation | 90 Matawan Rd Matawan NJ 07747 |  | kaxi at cypress.com |
| Saishankar Nandagopalan | Cypress Semiconductor Corporation |  |  | snan at cypress.com |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Abstract

This document contains editorial text change proposal in the physical layer section of an IEEE TGax Draft 0.4.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Include the description to TGax Editor for the changes, and update the details on Discussion #7
* Rev 2: Sync-up with the following contributions
	+ Delete HE trigger-based PPDU part change in Discussion #3 (covered by 16/1136r5, CID #286, CID#2137)
	+ Delete L-LTF part with BEAM\_CHANGE = 0 in Discussion #4 (covered by 16/1137r3,CID #2531)
	+ Reflect changes of 16/1148r6 (CID #226) in Discussion #6
	+ Delete the part in Discussion #7 (covered by 16/1137r3, CID #2531)
* Rev 3: Minor change in the Table 26-15
* Rev 4: Update the table based on 16/0915r2, Delete Discussion #3 since it is covered by 16/1136r5

**Discussion #1** (D0.4, P128L02, Section 26.3.3)**:**

Spatial and frequency mapping block is newly introduced in TGax and used in many places (Figure 26-9, Figure 26-10, Figure 26-11), but it is not listed in the block introduction. Please insert the new block named ‘Spatial and frequency mapping’ into the list.

**Proposed text change #1:**

------------------------------------------------------------

To TGax editor, Include the new item into the list as follows in D0.4, P128L02, Section 26.3.3:

* Spatial mapper
* Spatial and frequency mapping
1. Inverse discrete Fourier transform (IDFT)

------------------------------------------------------------

**Discussion #2** (D0.4, P141L07, Section 26.3.7.1):

The 106-tone RU and 242-tone RU are not described in the statement. Include those RUs as follows:

**Proposed text change #2:**

------------------------------------------------------------

To TGax Editor: Update the text as follows in D0.4, P141L07, Section 26.3.7.1

The 26-tone RU, 52-tone RU, 106-tone RU and 242-tone RU are used in the 20 MHz, 40 MHz, 80 MHz, 160 MHz and 80+80 MHz HE MU PPDU formats or HE trigger-based PPDU formats using OFDMA transmission.

------------------------------------------------------------

**Discussion #3** (D0.4, P152L09 Section 26.3.9):

The equations in 16/872r1 are not correctly reflected in D0.4. $η\_{Field,r}$ should be changed to $η\_{Field,k}$ and the summation for *m* should be upto $N\_{STS,r,u}$ in Equation (26-4).

**Proposed text change #3:**

------------------------------------------------------------

To TGax Editor: This change is requested in 11/1136r5, so no further action is required.

------------------------------------------------------------

**Discussion #4 (**D0.4, P135L09, P153L21, Section 26.3.9, P157L54, Section 26.3.10.4):

*TGI,*LegacyPreamble is declared in Table 26-13 and used for all guard interval duration on the legacy preamble, RL-SIG, HE-SIG-A and HE-SIG-B, but the value of *TGI,*LegacyPreamble is never defined in the specification. On the other hand, *TGI,*Pre-HE is defined in Table 26-3, but it is never used in the equations. Therefore, *TGI,*Pre-HE would be replaced to *TGI,*LegacyPreamble which corresponds to 0.8 us.

*TGI,*LegacyPreamble in equations (26-12) and (26-13) regarding L-LTF should be changed, and there is no definition for the length of the L-LTF. Therefore, define *TGI,*L-LTF which corresponds to 1.6 us.

*TGI,*HE-LTF1, *TGI,*HE-LTF2, and *TGI,*HE-LTF4 are declared in Table 26-13, but the value of those parameters are never defined in the specification. In addition, GI duration is depending on LTF+CP combination, which is not one-to-one mapping from HE-LTF mode. Moreover, the parameter *TGI,*HE-LTF is already described in Table 26-3 (D0.4, P135L40). Therefore, *TGI,*HE-LTF1, *TGI,*HE-LTF2, and *TGI,*HE-LTF4 would be replaced as *TGI,*HE-LTF.

The precise expression on the guard interval of HE-Data is represented as *TGI,Data* in Table 26-3. Therefore, change the guard interval description of HE-Data from “*TGI1,Data*(#2502), *TGI2,Data* or *TGI4,Data* ”to the representative *TGI,Data* for consistency.

**Proposed text change #4:**

------------------------------------------------------------

To TGax Editor: Update the Table 26-3 as follows in D0.4, P135L09 Section 26.3.9

Table 26-3 (Timing-related constants) defines the timing-related parameters for HE PPDU formats..

|  |
| --- |
| * Timing-related constants
 |
| Parameter | Values | Description |
|  | 312.5 kHz | Subcarrier frequency spacing for the pre-HE modulated fields(#279). |
|  | 78.125 kHz | Subcarrier frequency spacing for the HE modulated fields(#279). |
| *TDFT,*Pre-HE | 3.2 µs | IDFT/DFT period for the pre-HE modulated fields(#279). |
| *TDFT,*HE | 12.8 µs | IDFT/DFT period for the HE Data field(#279)(#Ed). |
| *TGI,*LegacyPreamble | 0.8 µs | Guard interval duration for the legacy preamble, RL-SIG, HE-SIG-A and HE-SIG-B |
| *TGI,*HE-LTF | *TGI1,Data*, *TGI2,Data* or *TGI4,Data* depending on the GI used for data | Guard interval duration for the HE-LTF field, same as *TGI,Data* |
| *TGI,*L-LTF | 1.6 µs | Guard interval duration for the L-LTF field. |
| *TGI,Data* | *TGI1,Data*, *TGI2,Data* or *TGI4,Data* depending on the GI used for data | Guard interval duration for the HE-Data field |
| *TGI1,Data* | 0.8 µs | Base guard interval duration for the HE-Data field. |
| *TGI2,Data* | 1.6 µs | Double guard interval duration for the HE-Data field. |
| *TGI4,Data* | 3.2 µs | Quadruple guard interval duration for the HE-Data field. |
| *TSYM1* | 13.6 µs = *TDFT,*HE + *TGI1,Data* = 1.0625 × *TDFT,HE*  | OFDM symbol duration with base GI(#1108)(#279) |
| *TSYM2* | 14.4 µs = *TDFT,*HE + *TGI2,Data* = 1.125 × *TDFT,HE* | OFDM symbol duration with double GI(#1109) |
| *TSYM4* | 16 µs = *TDFT,*HE + *TGI4,Data* = 1.25 × *TDFT,*HE | OFDM symbol duration with quadruple GI(#1110) |
| *TSYM* | *TSYM1*, *TSYM2*, or *TSYM4* depending on the GI used (see Table 26-13 (Tone scaling factor and guard interval duration values for HE PPDU fields)(#2757)) | Symbol interval |
| *T*L-STF | 8 µs = 10 × *TDFT,*Pre-HE /4 | Non-HT Short Training field duration |
| *T*L-LTF(#1040) | 8 µs = 2 × *TDFT,*Pre-HE + *TGI2,Data* | Non-HT Long Training field duration |
| *T*L-SIG | 4 µs | Non-HT SIGNAL field duration |
| *T*RL-SIG | 4 µs | Repeated non-HT SIGNAL field duration |
| *T*HE-SIG-A | 8 µs = 2 × 4 µs | HE-SIG-A field duration in an HE SU PPDU, HE MU PPDU and HE trigger-based PPDU |
| *T*HE-SIG-A-R | 16 µs = 4 × 4 µs(#279) | HE-SIG-A field duration in an HE extended range SU PPDU |
| *T*HE-STF-T | 8 µs = 5 × 1.6 µs | HE-STF field duration for an HE trigger-based PPDU |
| *T*HE-STF-NT | 4 µs = 5 × 0.8 µs | HE-STF field duration for an HE SU PPDU, HE extended range SU PPDU and HE MU PPDU |
| *T*HE-LTF-1X | 3.2 µs | Duration of each 1x HE-LTF OFDM symbol without GI |
| *T*HE-LTF-2X | 6.4 µs | Duration of each 2x HE-LTF OFDM symbol without GI |
| *T*HE-LTF-4X | 12.8 µs | Duration of each 4x HE-LTF OFDM symbol without GI |
| *T*HE-LTF | *T*HE-LTF-1X, *T*HE-LTF-2X or *T*HE-LTF-4X depending upon the LTF duration used | Duration of each OFDM symbol without GI in the HE-LTF field (#279) |
| *T*HE-LTF-SYM | sum of *T*HE-LTF and *TGI,*HE-LTF | Duration of each OFDM symbol including GI in the HE-LTF field |
| *T*HE-SIG-B | 4 µs = *TDFT,*Pre-HE + *TGI,*LegacyPreamble | Duration of each OFDM symbol in the HE-SIG-B field(#Ed) |
| *Nservice* | 16 | Number of bits in the SERVICE field |
| *Ntail* | 6 | Number of tail bits per BCC encoder |
| *TSYML* | 4 µs | Symbol duration including GI prior to the HE-STF field |
| *TPE* | 0, 4 µs, 8 µs, 12 µs or 16 µs depending on the actual extension duration used | Duration of the Packet Extension field(#279) |

To TGax Editor: Update the Table 26-13 as follows in D0.4, P152L48 Section 26.3.9

|  |
| --- |
| * Tone scaling factor and guard interval duration values for HE PPDU fields
 |
| Field |  as a function of bandwidth, and RU size per frequency segment | Guard interval duration |
| 20 MHz | 40 MHz | 80 MHz | 160 MHz |
| L-STF | 12 | 24 | 48 | 96 | - |
| L-LTF | 52 | 104 | 208 | 416 | *TGI,L-LTF* |
| L-SIG in an HE PPDU | 56 | 112 | 224 | 448 | *TGI,*LegacyPreamble |
| L-SIG in a non-HT duplicate PPDU(#1988) | - | 104 | 208 | 416 |
| RL-SIG | 56 | 112 | 224 | 448 |  *TGI,*LegacyPreamble |
| HE-SIG-A | 56 | 112 | 224 | 448 | *TGI,*LegacyPreamble |
| HE-SIG-B | 56 | 112 | 224 | 448 | *TGI,*LegacyPreamble |
| HE-STF not in an HE trigger-based PPDU | 14 | 30 | 62 | 126 | - |
| HE-STF in an HE trigger-based PPDU | 30 | 60 | 124 | 248 | - |
| HE-LTF 1x Duration | 60 | 122 | 250 | 500 | *TGI,*HE-LTF |
| HE-LTF 2x Duration | 122 | 242 | 498 | 996 | *TGI,*HE-LTF |
| HE-LTF 4x Duration | 242 | 484 | 996 | 1992 | *TGI,*HE-LTF |
| HE-Data | 242 | 484 | 996 | 1992 |  *TGI,Data* |
| NON\_HT\_DUP\_OFDM-Data(#1988) | - | 104 | 208 | 416 | *TGI,*LegacyPreamble |
| NOTE—in the case of an HE OFDMA PPDU, the  value of HE-STF, HE-LTF and HE-Data fields is variable, and is determined by which RUs of the current full bandwidth are transmitted in the PPDU. |

To TGax Editor: Replace the Eq (26-12) with red color changes in D0.4, P157L54, Section 26.3.10.4



------------------------------------------------------------

**Discussion #5** (D0.4, P156L01, P156L23, Section 26.3.10.2.1):

Table index is wrong. Change from Table 22-10 to Table 21-10 (TGmc D8.0) and change from Table 22-11 to Table 21-11 (TGmc D8.0).

**Proposed text change #5**

------------------------------------------------------------

To TGax Editor: Change the Table index number in D0.4, P156L01, Section 26.3.10.2.1

When the TXVECTOR parameter BEAM\_CHANGE is 1(#Ed), the cyclic shift value  for the L-STF, L-LTF, L-SIG, RL-SIG, HE-SIG-A and HE-SIG-B fields of the PPDU for transmit chain *iTX* out of a total of *NTX* are defined in Table 21-10 (Cyclic shift values for L-STF, L-LTF, L-SIG, and VHT-SIG-A fields of the PPDU). In UL MU transmission the cyclic shift value  is based on the transmit chain index of each STA.

To TGax Editor: Change the Table index number in D0.4, P156L23, Section 26.3.10.2.1

Throughout the HE modulated fields of the preamble, cyclic shifts are applied to prevent unintended beamforming when correlated signals are transmitted in multiple space-time streams. The same cyclic shift is also applied to these streams during the transmission of the Data field of the HE PPDU. The cyclic shift value  for the HE modulated fields for space-time stream *n* out of *NSTS,total* total space-time streams is shown in Table 21-11 (Cyclic shift values for the VHT modulated fields of a PPDU).

------------------------------------------------------------

**Discussion #6** (D0.4, P162L30, Section 26.3.10.7.2):

For HE EXT SU PPDU, HE-SIG-A2 should be changed to HE-SIG-A3 in Table 26-15 based on HE-SIG-A symbol number definition.

In addition, the number of bits for LTF+CP Size field in Table 26-15 is wrong. It should be 2 bits instead of 3 bits.

**Proposed text change #6:**

------------------------------------------------------------

To TGax Editor: Note this change is also including the changes of 11/0915r2 and 11/1148r6. Please update Table 26-15 with marked changes in D0.4, P162L30, Section 26.3.10.7.2

The HE-SIG-A field for an HE SU PPDU or an HE extended range SU PPDU contains the fields listed in Table 26-15 (HE-SIG-A field of an HE SU PPDU and HE extended range SU PPDU(#Ed)).

|  |
| --- |
| * HE-SIG-A field of an HE SU PPDU and HE extended range SU PPDU(#Ed)
 |
| Two Parts of HE-SIG-A | Bit | Field | Number of bits | Description |
| HE-SIG-A1 | B0 | Format | 1 | Differentiate an HE SU PPDU from an HE trigger-based PPDU:(#1685)Set to 0 for HE trigger-based PPDU Set to 1 for HE SU PPDU This field is reserved and set to 1 for an HE extended range SU PPDU.(#1196) |
|  | B1 | Beam Change | 1 | Set to 1 indicates that the pre-HE-STF portion of the SU PPDU is spatially mapped differently from HE-LTF1.Set to 0 indicates that the pre-HE-STF portion of the SU PPDU is spatially mapped the same way as HE-LTF1 on each tone. |
|  | B2 | UL/DL | 1 | Indicates whether the PPDU is sent UL or DL:Set to 0 for DLSet to 1 for UL(#2002)This field indicates DL for TDLS, mesh and IBSS.NOTE—The TDLS peer can identify the TDLS frame by To DS and From DS fields in the MAC header of the MPDU. |
|  | B3-B6 | MCS | 4 | For an HE SU PPDU:Set to *n* for MCS*n*, where *n* = 0, 1, 2, …., 11Values 12-15 are reserved For HE extended range SU PPDU with Bandwidth field set to 0 (242-tone RU):Set to *n* for MCS*n*, where *n* = 0, 1, 2Values 3-15 are reservedFor HE extended range SU PPDU with Bandwidth field set to 1 (right 106-tone RU in P20):Set to 0 for MCS 0Values 1-15 are reserved |
|  | B7 | DCM | 1 | Indicates whether or not DCM is applied to the Data field for the MCS indicated.Set to 1 to indicate that DCM is applied to the Data fieldSet to 0 to indicate that DCM is not applied to the Data field.DCM is only applied for MCS0, MCS1, MCS3 and MCS4.DCM is only applied for 1 and 2 spatial streams. DCM is not applied when STBC is used.(#2007) |
|  | B8-B13 | BSS Color | 6 | The BSS Color field is an identifier of the BSS |
|  | B14 | Reserved | 1 | Reserved and set to 1(PHY Motion #162) |
|  | B15-B18 | Spatial Reuse | 4 | Set to SR disallowed Entry to disallow SRP-based spatial reuse (see 25.9.2 (Color code based CCA rules) and 25.11a (TXVECTOR parameters SPATIAL\_REUSE for an HE PPDU)).Notes: this part needs further development.(#2169) |
|  | B19-B20 | Bandwidth | 2 | For an HE SU PPDU:Set to 0 for 20 MHzSet to 1 for 40 MHzSet to 2 for 80 MHzSet to 3 for 160 MHz and 80+80 MHz(#Ed)For an HE extended range SU PPDU:Set to 0 for 242-tone RUSet to 1 for right 106-tone RU within the primary 20 MHz |
|  | B21-B22 | LTF + GI(#1420) | 2 | Indicates the GI duration(#1420) and HE-LTF size.Set to 0 to indicate a 1x HE-LTF and 0.8 µs GISet to 1 to indicate a 2x HE-LTF and 0.8 µs GISet to 2 to indicate a 2x HE-LTF and 1.6 µs GISet to 3 to indicate a 4x HE-LTF and 3.2 µs GI(#2005) |
|  | B23-B25 | Nsts | 3 | Indicates the number of space time streams.(#1457)For an HE SU PPDU:Set to the number of space time streams minus 1For an HE extended range SU PPDU:Set to 0 for one space time stream when STBC field is set to 0Set to 1 for two space time streams when STBC field is set to 1Values 2-7 are reserved |
| HE-SIG-A2 for HE\_SU PPDU or HE-SIG-A3 for HE\_EXT\_SU PPDU | B0-B6 | TXOP Duration | 7 | Set to 127 to indicate no duration information. Set to value other than 127 to indicate duration information for NAV setting and protection of the TXOP.NOTE—The encoding of TXOP Duration field is the same as the TXOP\_DURATION parameter(#Ed) in Table 26-1 (TXVECTOR and RXVECTOR parameters(#1780)).(#783) |
|  | B7 | Coding | 1 | Indicates whether BCC or LDPC is used:Set to 0 to indicate BCCSet to 1 to indicate LDPC(#1197) |
|  | B8 | LDPC Extra Symbol Segment | 1 | Indicates the presence of the extra OFDM symbol for LDPC.(#1197)Set to 1 if an extra OFDM symbol for LDPC is presentSet to 0 if an extra OFDM symbol for LDPC is presentReserved and set to 1 when the Coding field is 0. |
|  | B9 | STBC | 1 | Set to 1 if space time block coding is usedSet to 0 otherwise |
|  | B10 | TxBF | 1 | Set to 1 if a Beamforming steering matrix is applied to the waveform in an SU transmissionSet to 0 otherwise |
|  | B11-B12 | A-factor | 2 | Indicate the "a-factor" value as defined in Table 26-37 (a-factor subfield encoding).(#2534) |
|  | B13 | PE Disambiguity | 1 | Indicate PE Disambiguity as defined in 26.3.12 (Packet extension(#1781)).(#2534) |
|  | B14 | Reserved | 1 | Reserved and set to 1 |
|  | B15 | Doppler | 1 | Set to 0 if Doppler mode is not usedSet to 1 if Doppler mode is used(#2167) |
|  | B16-B19 | CRC | 4 | CRC for bits 0-41 of the HE-SIG-A field (see 26.3.10.7.3 (CRC computation)). The first bit to be transmitted is bit *c7* as explained in 26.3.10.7.3 (CRC computation)).(#2535) |
|  | B20-B25 | Tail | 6 | Used to terminate the trellis of the convolutional decoder.Set to 0. |
| NOTE—Integer fields are transmitted in unsigned binary format, LSB first, where the LSB is in the lowest numbered bit position. |

------------------------------------------------------------

**Discussion #7 (**D0.4, P170L48, P171L19, Section 26.3.10.7.4)

The equation (26-19) regarding BEAM\_CHANGE = 0 is wrongly modified in D0.3 (CID #525, 16/0937r7), which does not consider beamforming at all and does not use $p\_{n+2}$ for the sequence. Therefore, it is required to retrieve the equation from D0.2 and apply the minor fix on $i\_{BW}$ range.

For equation (26-21), the set of 20MHz channels is {0,1,…, $N\_{20MHz}-1\}$, and *m* parameter range should be {1, …,$N\_{STS,total}$}.

**Proposed text change #7:**

---------------------------------------------------------------

To TGax Editor: The change is already covered in 11/1137r3 with summation range correction to 0,…,$ N\_{20MHz}-1$. No further action is required.

---------------------------------------------------------------

**Discussion #8 (**D0.4, P179L41, Section 26.3.10.8.5):

RU allocation subfield value in Figure 26-25 is wrong, and yyy is changed to y2y1y0. The current value 01000011 in Figure 26-25 describes four MU-MIMO STAs. It should be 01000y2y1y0 = 01000010 to indicate three MU-MIMO users, so please change Figure 26-25 as follows (Visio inserted object):

**Proposed text change #8:**

---------------------------------------------------------------

To TGax Editor: Replace Figure 26-25 with the fix and high resolution in D0.4, P179L41, Section 26.3.10.8.5



---------------------------------------------------------------

**Discussion #9** (D0.4, P220L16, P222L21, Section 26.3.12)

Section number is wrong, Change from 8.4.2.1 to 9.4.2.1, and equation (26 113) is not a valid number. Update to (26-119).

**Proposed text change #9:**

---------------------------------------------------------------

To TGax Editor: Change the section number in D0.4, P220L16, Section 26.3.12

For an(#2829) HE PPDU, the maximum PE durations as defined by the Maximum PE capabilities in HE capabilities (9.4.2.1 (HE Capabilities Element)) are 0 µs, 8 µs and 16 µs.

To TGax Editor: Change the equation number in D0.4, P222L21, Section 26.3.12

The PE Disambiguity(#1049) subfield of the Packet Extension field shall be set to 1 if the condition in Equation (26-119) is met, otherwise it shall be set to 0.

---------------------------------------------------------------

**References**

[1] IEEE P802.11ax™/D0.4

[2] IEEE 802.11-16/0937r7, “11ax Comment Resolutions for Clauses 26.3.2-26.3.9.3-26.3.9.4-26.3.9.5-26.3.10.2- 26.3.10.13”

[3] IEEE 802.11-16/1136r5, “11ax comment resolutions for clause 26.3.8”

[4] IEEE 802.11-16/1137r3, “11ax comment resolutions for clause 26.3.9”

[5] IEEE 802.11-16/1148r6, “CR HE-SIG-A part III”

[6] IEEE 802.11-16/0915r2 “Bit field finalization of HE-SIG-A in HE PPDU formats”