IEEE P802.11
Wireless LANs

|  |
| --- |
| Proposed Draft Text (PDT-PHY): Timing Related Parameters |
| Date: 2020-07-29 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Lin Yang | Qualcomm |  |  |  |
| Bin Tian | Qualcomm |  |  | btian@qti.qualcomm.com |

Abstract

This submission proposed the draft text on Timing related Parameters for TGbe D0.1

33.3.x Timing-related parameters

Refer to Table 19-6 (Timing-related constants), Table 21-5 (Timing-related constants) and Table 27-12 (Timing related constants) for timing-related parameters for non-EHT PPDU formats.

Table 1 - Timing-related constants defines the timing-related parameters for EHT PPDU formats.

|  |
| --- |
| **Table 1 - Timing-related constants** |
| Parameter | Values | Description |
| $$∆\_{F,Pre-EHT}$$ | 312.5 kHz | Subcarrier frequency spacing for the pre-EHT modulated fields |
| $$∆\_{F,EHT}$$ | 78.125 kHz | Subcarrier frequency spacing for the EHT modulated fields |
| *TDFT,*Pre-EHT | 3.2 µs | IDFT/DFT period for the pre-EHT modulated fields |
| *TDFT,*EHT | 12.8 µs | IDFT/DFT period for the EHT Data field. |
| *TGI,*Pre-EHT | 0.8 µs | Guard interval duration for the pre-EHT modulated fields |
| *TGI,*L-LTF | 1.6 µs | Guard interval duration for the L-LTF field. |
| *TGI1,Data* | 0.8 µs | Base guard interval duration for the Data field |
| *TGI2,Data* | 1.6 µs | Double guard interval duration for the Data field |
| *TGI4,Data* | 3.2 µs | Quadruple guard interval duration for the Data field. |
| *TGI,*EHT-LTF | *TGI1,Data*, *TGI2,Data* or *TGI4,Data* depending on the GI used for data | Guard interval duration for the EHT-LTF field, same as *TGI,Data* |
| *TGI,Data* | *TGI1,Data*, *TGI2,Data* or *TGI4,Data* depending on the GI used for data | Guard interval duration for the Data field. |
| *TSYM1* | 13.6 µs = *TDFT,*EHT + *TGI1,Data* = 1.0625 × *TDFT,EHT*  | OFDM symbol duration with base GI |
| *TSYM2* | 14.4 µs = *TDFT,*EHT + *TGI2,Data* = 1.125 × *TDFT,EHT* | OFDM symbol duration with double GI |
| *TSYM4* | 16 µs = *TDFT,*EHT + *TGI4,Data* = 1.25 × *TDFT,*EHT | OFDM symbol duration with quadruple GI |
| *TSYM* | *TSYM1*, *TSYM2*, or *TSYM4* depending on the GI used for data | OFDM symbol interval for EHT PPDU fields. See Table x (Number of modulated subcarriers and guard interval duration values for EHT PPDU fields). |
| *T*L-STF | 8 µs = 10 × *TDFT,*Pre-EHT /4 | Non-HT Short Training field duration |
| *T*L-LTF | 8 µs = 2 × *TDFT,*Pre-EHT + *TGI,*L-LTF | 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*U-SIG | 8 µs = 2 × 4 µs | U-SIG field duration in an EHT PPDU |
| *T*EHT-SIG | 4 µs = *TDFT,*Pre-EHT + *TGI,*Pre-EHT | Duration of each OFDM symbol in the EHT-SIG field |
| *T*EHT-STF-T | 8 µs = 5 × 1.6 µs | EHT-STF field duration for an EHT TB PPDU |
| *T*EHT-STF-NT | 4 µs = 5 × 0.8 µs | EHT-STF field duration for a non-TB EHT PPDU |
| *T*EHT-LTF-1X | 3.2 µs | Duration of each 1x EHT-LTF OFDM symbol without GI |
| *T*EHT-LTF-2X | 6.4 µs | Duration of each 2x EHT-LTF OFDM symbol without GI |
| *T*EHT-LTF-4X | 12.8 µs | Duration of each 4x EHT-LTF OFDM symbol without GI |
| *T*EHT-LTF | *T*EHT-LTF-1X, *T*EHT-LTF-2X or *T*EHT-LTF-4X depending upon the EHT-LTF duration used | Duration of each OFDM symbol without GI in the EHT-LTF field |
| *T*EHT-LTF-SYM | *T*EHT-LTF + *TGI,*EHT-LTF | Duration of each OFDM symbol including GI in the EHT-LTF field |
| *Nservice* | 16 | Number of bits in the SERVICE field |
| *Ntail*, *Ntail,u* | 6 for BCC encoder, 0 for LDPC encoder | Number of tail bits per encoder (for user *u*) |
| *TSYML* | 4 µs | OFDM symbol duration including GI prior to the EHT-STF field |
| *TPE* | 0, 4 µs, 8 µs, 12 µs, or 16 µs depending on the actual extension duration used | Duration of the PE field |

Table 2 - Subcarrier allocation related constants for the EHT-modulated fields in a full bandwidth non-OFDMA EHT **PPDU** defines tone allocation related parameters for a full bandwidth non-OFDMA EHT PPDU.

**Table 2 - Subcarrier allocation related constants for the EHT-modulated fields in a full bandwidth non-OFDMA EHT PPDU** (Note: CBW80+80 and CBW 160+160 TBD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | CBW20 | CBW40 | CBW80 | CBW160 | CBW320 | Description |
| *NSD* | 234 | 468 | 980 | 1960 | 3920 | Number of data subcarriers per frequency segment |
| *NSP* | 8 | 16 | 16 | 32 | 64 | Number of pilot subcarriers per frequency segment |
| *NST* | 242 | 484 | 996 | 1992 | 3984 | Total number of subcarriers per frequency segment |
| *NSR* | 122 | 244 | 500 | 1012 | 2036 | Highest data subcarrier index per frequency segment |
| *NSeg* | 1 | 1 | 1 | 1 | 1 | Number of frequency segments |
| *NDC* | 3 | 5 | 5 | 23 | 23 | Number of null subcarriers at DC per segment |
| *NGuard,Left* | 6 | 12 | 12 | 12 | 12 | Number of low frequency guard subcarriers |
| *NGuard,Right* | 5 | 11 | 11 | 11 | 11 | Number of high frequency guard subcarriers |

Table 3 - Subcarrier allocation related constants for the EHT-modulated fields in a punctured non-OFDMA EHT PPDU defines tone allocation related parameters for a punctured non-OFDMA EHT PPDU.

**Table 3 - Subcarrier allocation related constants for the EHT-modulated fields in a punctured non-OFDMA EHT PPDU**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | CBW80 with 20 MHz puncturing (484+242) | CBW160 with 40 MHz puncturing (996+484) | CBW160 with 20 MHz puncturing (996+484+242) | CBW320 with 120 MHz puncturing (2x996+484) | CBW320 with 80 MHz puncturing(3x996) | CBW320 with 40 MHz puncturing (3x996+484) | Description |
| *NSD* | 702 | 1448 | 1682 | 2428 | 2940 | 3408 | Number of data subcarriers per frequency segment |
| *NSP* | 24 | 32 | 40 | 48 | 48 | 64 | Number of pilot subcarriers per frequency segment |
| *NST* | 726 | 1480 | 1722 | 2476 | 2988 | 3472 | Total number of subcarriers per frequency segment |
| *NSR* | 500 | 1012 | 1012 | 2036 | 2036 | 2036 | Highest data subcarrier index per frequency segment |
| *NSeg* | 1 | 1 | 1 | 1 | 1 | 1 | Number of frequency segments |
| *NDC* | 5 | 23 | 23 | 23 | 23 | 23 | Number of null subcarriers at DC per segment |
| *NGuard,Left* | 12 | 12 | 12 | 12 | 12 | 12 | Number of low frequency guard subcarriers |
| *NGuard,Right* | 11 | 11 | 11 | 11 | 11 | 11 | Number of high frequency guard subcarriers |

Table 4 - Subcarrier allocation related constants for RUs in an OFDMA EHT PPDU defines tone allocation related parameters for an OFDMA EHT PPDU.

**Table 4 - Subcarrier allocation related constants for RUs in an OFDMA EHT PPDU**

|  |  |  |
| --- | --- | --- |
| Parameter | RU Size (subcarriers) | Description |
| 26 | 52 | 106 | 242 | 484 | 996 | 2×996 | 3x996 | 4×996 |
| *NSD* | 24 | 48 | 102 | 234 | 468 | 980 | 1960 | 2940 | 3920 | Number of data subcarriers per RU |
| *NSP* | 2 | 4 | 4 | 8 | 16 | 16 | 32 | 48 | 64 | Number of pilot subcarriers per RU |
| *NST* | 26 | 52 | 106 | 242 | 484 | 996 | 1992 | 2988 | 3984 | Total number of subcarriers per RU |
| NOTE: *NST* = *NSD*+ *NSP* |

Table 5 - Subcarrier allocation related constants for MRUs in an OFDMA EHT PPDU defines tone allocation related parameters for an OFDMA EHT PPDU.

Note: TBD on the notation of MRU and whether to treat an MRU as just a new RU size. Table 5 can be merged into the Table 4 if needed

**Table 5 - Subcarrier allocation related constants for MRUs in an OFDMA EHT PPDU**

|  |  |  |
| --- | --- | --- |
| Parameter | MRU Size (subcarriers) | Description |
| 52+26 | 106+26 | 484+242 | 996+484 | 2×996+484 | 3x996 | 3×996+484 |
| *NSD* | 72 | 126 | 702 | 1448 | 2428 | 2940 | 3408 | Number of data subcarriers per MRU |
| *NSP* | 6 | 6 | 24 | 32 | 48 | 48 | 64 | Number of pilot subcarriers per MRU |
| *NST* | 78 | 132 | 726 | 1480 | 2476 | 2988 | 3472 | Total number of subcarriers per MRU |
| NOTE: *NST* = *NSD*+ *NSP* |

Table 6 - Frequently used parameters defines parameters used frequently in Clause 33 (Extremely High Throughput (EHT) PHY specification).

**Table 6 - Frequently used parameters**

|  |
| --- |
|  |
| Symbol | Explanation |
| *NRU* | For pre-EHT modulated fields, *NRU* = 1.-For EHT modulated fields, *NRU* represents the number of occupied RUs or MRUs in the transmission. |
| *Nuser,r* | For pre-EHT modulated fields, *Nuser,r* = 1. For EHT modulated fields, *Nuser,r* represents the total number of users in the *r*-th occupied RU or MRU of the transmission. |
| *Nuser,total* | Total number of users in all occupied RUs or MRUs of an EHT transmission, i.e.,  |
| *NCBPS,u* | Number of coded bits per OFDM symbol for user *u*, *u* = 0, …, *Nuser,total* – 1 |
| *NCBPSS,u* | Number of coded bits per OFDM symbol per spatial stream for user *u*, *u* = 0, …, *Nuser,total* – 1.  |
| *NDBPS,u* | Number of data bits per OFDM symbol for user *u*, *u* = 0, …, *Nuser,total* – 1. |
| *NBPSCS,u* | Number of coded bits per subcarrier per spatial stream for user *u*, *u* = 0, …, *Nuser,total* – 1. |
| *NRX* | Number of receive chains |
| *NSTS,r,u* | For EHT modulated fields, *NSTS,r,u* represents the number of space-time streams in the *r*-th occupied RU or MRU for user *u*, *u* = 0, …, *Nuser,r* – 1. For STBC, *NSTS,r,u* = 2 (Note: STBC TBD).For an EHT PPDU, *NSTS* is undefined if any one of the RUs or MRUs is assigned to more than one user, and *NSTS* = 2 if all RUs are assigned to no more than one user and the STBC field is set to 1. (Note: STBC TBD). |
| *NSTS,r,total* | For EHT modulated fields, *NSTS,r,total* is the total number of space-time streams over all the users in the *r*-th occupied RU or MRU.For pre-EHT modulated fields, *NSTS,r,total* is undefined.NOTE— *NSTS,r,total* = *NSTS* for only one user in EHT PPDU. |
| *NSS,r,u*, *NSS,u* | Number of spatial streams. For the Data field, *NSS,r,u* is the number of spatial streams at *r*-th RU or MRU for user *u*, *u* = 0, …, *Nuser,r* – 1 and *NSS,u* is the number of spatial streams for user *u*, *u* = 0, …, *Nuser,total* – 1.For the Data field of an EHT MU PPDU,  |
| *NSS,r,total* | For EHT modulated fields, *NSS,r,total* is the total number of spatial streams at *r*-th RU or MRU in a PPDU.For pre-EHT modulated fields, *NSS,r,total* is undefined.NOTE— *NSS,r,total* = *NSS* for SU transmission in EHT PPDU. |
| *NTX* | Number of transmit chains |
| *NEHT-LTF* | The number of OFDM symbols in the EHT-LTF field (see xxx (EHT-LTF)) |
| *NEHT-SIG* | The number of OFDM symbols in the EHT-SIG field (see xxx (EHT-SIG)) |
| *Kr* | Set of used subcarrier indices in the *r*-th occupied RU or MRU |
| *Ru* | *Ru* is the coding rate for user *u*, *u* = 0, …, *Nuser,total* – 1. |
| *Mr,u* | The sum of the number of space-time streams of users prior to user *u* in RU or MRU *r*. For pre-EHT modulated fields, *Mr,u* = 0. For EHT modulated fields, *Mr,0* = 0 for *u* = 0 and  for *u* = 1, …, *Nuser,r* – 1. |