IEEE P802.11
Wireless LANs

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| PDT DL non-AMP portion preamble |
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Abstract

This document contains Proposed Draft Text (PDT) for DL non-AMP portion preamble of the proposed TGbp amendment to the 802.11 standard.

**Revisions:**

* Rev 0: Initial version of the document. Green parts are TBD and will bring contributions later.
* Rev 1: Modify the document based on comments from Alice. Still some unresolved comments.

**The proposed changes within this document are also based on the following motions adopted by the TGbp task group:**

[Motion #28, [1]]

* The preamble of an AMP DL PPDU includes L-STF, L-LTF, L-SIG, RL-SIG, and U-SIGs for AMP enabled non-AP STA and active TX non-AP AMP STA in 2.4 GHz.

 [Motion #86, [1]]

* The RATE field in L-SIG of an AMP DL PPDU in 2.4 GHz shall be set to the value representing 6 Mb/s in the 20 MHz channel spacing.
* The LENGTH field in L-SIG of an AMP DL PPDU in 2.4 GHz is set to a value satisfying the condition that the remainder is zero when LENGTH is divided by 3.

[Motion #87, [1]]

* An DL AMP PPDU in 2.4 GHz is identified in its U-SIG with the following setting:
* PHY version value sets to 0
* One or multiple Validate bit subfields sets to 0 or subfield(s) set to a validate state.

**Text to be adopted begins here.**

***TGbp editor: Please add the following new subclause for DL non-AMP portion preamble to the 802.11bp draft D0.1:***

**40.3.8.2.1 Non-AMP portion of AMP PHY preamble**

The Non-AMP portion of the AMP PHY preamble consists of five fields: L-STF, L-LTF, L-SIG, RL-SIG, and U-SIG.

**40.3.8.2.1.1 L-STF**

The time domain representation of the L-STF field, transmitted on transmit chain *iTX* shall be as specified in [Equation (40-X1)](file:///C%3A%5CUsers%5Cmtk28741%5CDesktop%5C11-24-2033-03-00bn-pdt-phy-legacy-preamble.docx#_bookmark92).

$r\_{L-STF}^{i\_{TX}}\left(t\right)=\frac{ε}{\sqrt{N\_{TX}N\_{L-STF}^{Tone}}}w\_{T\_{L-STF}}\left(t\right)\sum\_{i\_{BW}\in Ω\_{20MHz}}^{}\sum\_{k=-26}^{26}$

$ γ\_{\left(k-K\_{Shift}\left(i\_{BW}\right)\right),BW}S\_{k,20}exp\left(j2π\left(k-K\_{Shift}\left(i\_{BW}\right)\right)Δ\_{F,Pre-AMP}\left(t-T\_{CS}^{i\_{TX}}\right)\right)$ (40-X1)

where

$ε$ is a power scaling factor with the value $ε=\sqrt{\frac{N\_{L-LTF}^{Tone}}{N\_{L-SIG}^{Tone}}}$

$N\_{L-STF}^{Tone}$ is the value given in Table 36-26 (Number of modulated subcarriers and guard interval duration values for EHT PPDU fields).

*iBW* is the index of 20 MHz channels, 0 ≤ *iBW* ≤ 1.

$Ω\_{20MHz}$ is the set of 20 MHz subchannels that are located.

$K\_{Shift}\left(i\right)=(N\_{20MHz}-1-2i)∙32$

*Sk,20* is defined as *Sk*, where *Sk* is an element of *S-26,26* for $-26\leq k\leq 26 $from Equation (19-8).

$T\_{CS}^{i\_{TX}}$ represents the cyclic shift for transmit chain *iTX* with a value given in 36.3.12.2.1 (Cyclic shift for pre-EHT modulated fields).

Other variables in Equation (40-X1) are defined in 40.x.xx (Timing-related parameters) and 40.x.xx (Mathematical description of signals).

**40.3.8.2.1.2 L-LTF**

The time domain representation of the L-LTF field, transmitted on transmit chain *iTX*, shall be as specified in [Equation (40-X2)](file:///C%3A%5CUsers%5Cmtk28741%5CDesktop%5C11-24-2033-03-00bn-pdt-phy-legacy-preamble.docx#_bookmark92).

 $r\_{L-LTF}^{i\_{TX}}\left(t\right)=\frac{ε}{\sqrt{N\_{TX}∙N\_{L-LTF}^{Tone}}}w\_{T\_{L-LTF}}\left(t\right)\sum\_{i\_{BW}\in Ω\_{20MHz}}^{}\sum\_{k=-26}^{26}$

$ γ\_{\left(k-K\_{Shift}\left(i\_{BW}\right)\right),BW}L\_{k,20}exp\left(j2π\left(k-K\_{Shift}\left(i\_{BW}\right)\right)Δ\_{F,Pre-AMP}\left(t-T\_{GI,L-LTF}-T\_{CS}^{i\_{TX}}\right)\right)$ (40-X2)

where

$N\_{L-LTF}^{Tone}$ is the value given in Table 36-26 (Number of modulated subcarriers and guard interval duration values for EHT PPDU fields).

*Lk,20* is defined as *Lk*, where *Lk* is an element of *L-26,26* for $-26\leq k\leq 26 $from Equation (17-8).

$T\_{GI,L-LTF}$ is given in Table 40-xx (Timing-related constants)

Other variables in Equation (40-X2) are defined below Equation (40-X1) as well as in 40.x.xx (Timing-related parameters) and 40.x.xx (Mathematical description of signals).

**40.3.8.2.1.3 L-SIG**

The L-SIG field is used to communicate rate and length information. The structure of the L-SIG field is defined in Figure 17-5 (SIGNAL field bit assignment).

In a AMP PPDU, the RATE field shall be set to the value representing 6 Mb/s in the 20 MHz channel spacing column of Table 17-6 (Contents of the SIGNAL field).

The LENGTH field in an AMP PPDU is set to a value satisfying the condition that the remainder is zero when LENGTH is divided by 3.

 $Length= \left⌈\frac{TXTIME-SignalExension-20}{4}\right⌉×3-3$ (40-X3)

where

 TXTIME (in microseconds) is defined in 40.x.xx (TXTIME and PSDU LENGTH calculation).

 *SignalExtension* is defined in Table 27-61 (HE PHY characteristics).

The Reserved (R) field shall be set to 0.

The Parity (P) field has the even parity of bits 0-16.

The SIGNAL TAIL field shall be set to 0.

The L-SIG field shall be encoded, interleaved, and mapped following the steps described in 17.3.5.6 (Convolutional encoder), 17.3.5.7 (Data interleaving), and 17.3.5.8 (Subcarrier modulation mapping). The stream of 48 complex numbers generated by these steps is denoted by $d\_{k},k=0,…,47$ and are mapped to subcarriers [–26, 26]. In addition, values [–1, –1, –1, 1] are mapped to the extra subcarriers [–28, –27, 27, 28] of the L-SIG field of a 20 MHz AMP PPDU. Pilots shall be inserted as described in 17.3.5.9 (Pilot subcarriers).

The time domain waveform of the L-SIG field, transmitted on transmit chain *iTX*, shall be as given by [Equation (40-X4)](file:///C%3A%5CUsers%5Cmtk28741%5CDesktop%5C11-24-2033-03-00bn-pdt-phy-legacy-preamble.docx#_bookmark92).

$r\_{L-SIG}^{i\_{TX}}\left(t\right)=\frac{1}{\sqrt{N\_{TX}∙N\_{L-SIG}^{Tone}}}w\_{T\_{L-SIG}}\left(t\right)\sum\_{i\_{BW}\in Ω\_{20MHz}}^{}\sum\_{k=-28}^{28}γ\_{\left(k-K\_{Shift}\left(i\_{BW}\right)\right),BW}\left(D\_{k,20}+p\_{0}P\_{k}\right)$

$ exp\left(j2π\left(k-K\_{Shift}\left(i\_{BW}\right)\right)Δ\_{F,Pre-AMP}\left(t-T\_{GI,Pre-AMP}-T\_{CS}^{i\_{TX}}\right)\right)$ (40-X4)

where

$N\_{L-SIG}^{Tone}$ is the value given in Table 36-26 (Number of modulated subcarriers and guard interval duration values for EHT PPDU fields).

$$ D\_{k,20}=\left\{\begin{matrix}\begin{matrix}\begin{matrix}0, k=0,\pm 7,\pm 21\\-1, k=-28,\pm 27\end{matrix}\\1, k=28\end{matrix}\\d\_{M\_{20}^{r}(k)}, otherwise \end{matrix}\right.$$

$M\_{20}^{r}\left(k\right)=\left\{\begin{array}{c}\begin{matrix}k+26, -26\leq k\leq -22\\k+25, -20\leq k\leq -8 \\k+24, -6\leq k\leq -1 \end{matrix}\\k+23, 1\leq k\leq 6 \\k+22, 8\leq k\leq 20 \\k+21, 22\leq k\leq 26 \end{array}\right.$

$P\_{k}$ is defined in 17.3.5.10 (OFDM modulation).

$p\_{0}$ is the first pilot value in the sequence defined in 17.3.5.10 (OFDM modulation).

$T\_{GI,L-AMP}$ is given in Table 40-xx (Timing-related constants)

Other variables in Equation (40-X4) are defined below Equation (40-X1) as well as in 40.x.xx (Timing-related parameters) and 40.x.xx (Mathematical description of signals).

**40.3.8.2.1.4 RL-SIG**

The RL-SIG field is a repeat of the L-SIG field and is used to differentiate an AMP PPDU from a non-HT PPDU, HT PPDU, and VHT PPDU.

The time domain waveform of the RL-SIG field, transmitted on transmit chain *iTX*, shall be as given by [Equation (40-X5)](file:///C%3A%5CUsers%5Cmtk28741%5CDesktop%5C11-24-2033-03-00bn-pdt-phy-legacy-preamble.docx#_bookmark98).

$r\_{RL-SIG}^{i\_{TX}}\left(t\right)=\frac{1}{\sqrt{N\_{TX}∙N\_{RL-SIG}^{Tone}}}w\_{T\_{RL-SIG}}\left(t\right)\sum\_{i\_{BW}\in Ω\_{20MHz}}^{}\sum\_{k=-28}^{28}γ\_{\left(k-K\_{Shift}\left(i\_{BW}\right)\right),BW}\left(D\_{k,20}+p\_{1}P\_{k}\right)$

$ exp\left(j2π\left(k-K\_{Shift}\left(i\_{BW}\right)\right)Δ\_{F,Pre-AMP}\left(t-T\_{GI,Pre-AMP}-T\_{CS}^{i\_{TX}}\right)\right)$ (40-X5)

where

$p\_{1}$ is the second pilot value in the sequence defined in 17.3.5.10 (OFDM modulation).

Other variables in Equation (40-X4) are defined below Equation (40-X1) as well as in 40.x.xx (Timing-related parameters) and 40.x.xx (Mathematical description of signals).

**40.3.8.2.1.5 U-SIG**

**40.3.8.2.1.5.1 General**

The U-SIG field carries information necessary to interpret AMP DL PPDUs. The integer fields of the U-SIG field are transmitted in unsigned binary format, LSB first, where the LSB is in the lowest numbered bit position.

**40.3.8.2.1.5.2 Content**

The U-SIG field in the AMP preamble is designed for backward and forward compatibility. It includes 5 version independent fields (i.e., PHY Version Identifier, Bandwidth, UL/DL, BSS Color, and TXOP) in the beginning and CRC and Tail fields at the end, where each of these fields has consistency in location, bitwidth and interpretation across multiple IEEE 802.11 PHY clauses that are defined for 2.4 GHz, 5 GHz, and 6 GHz spectrum starting from Clause 36 (Extremely high throughput (EHT) PHY specification). In addition, the U-SIG field in the AMP DL PPDU preamble only applies in 2.4GHz using 20MHz.

The length of the U-SIG field for an AMP DL PPDU is two OFDM symbols.

An AMP DL PPDU in 2.4 GHz is identified in the U-SIG field via PHY Version Identifier sets to 0, and TBD bit(s) or subfield(s) sets to a validate state. AMP non-AP STAs are not required to decode the U-SIG contents.

~~Similar to its counterparts of the U-SIG in a EHT preamble, reserved fields in the AMP DL PPDU preamble or reserved values of the fields in the AMP DL PPDU preamble are divided into two categories: Validate and Disregard. For further details on the definition of these two categories, refer to 36.3.12.7.2 (Content).~~

The U-SIG field for an AMP PPDU contains the fields listed in Table 40-X6 (U-SIG field of an AMP DL PPDU).

**Table 40-X6—U-SIG field of an AMP DL PPDU**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
| U-SIG-1 | B0–B2 | PHY Version Identifier | 3 | Differentiate between different PHY clauses.Set to 0 for AMP DL PPDU if TBD condition. Values 1–7 are Validate.NOTE—A value of 0 indicates EHT (see 36.3.12.7.2) if TBD condition is not matched.  |
| ndition | B3–B5 | Bandwidth | 3 | Set to 0 for 20 MHz.Values 1–7 are Validate. |
|  | B6 | UL/DL | 1 | Set to 0 to indicate the PPDU is address to a non-AP STA.Value 1 is Validate. |
|  | B7–B12 | BSS Color | 6 | An identifier of the BSS.Set to the TXVECTOR parameter BSS COLOR. |
|  | B13–B19 | TXOP | 7 | If the TXVECTOR parameter TXOP\_DURATION is UNSPECIFIED, set to 127 to indicate the absence of duration information.If the TXVECTOR parameter TXOP\_DURATION is an integer value, set to a value less than 127 to indicate duration information for NAV setting and protection of the TXOP as follows:If the TXVECTOR parameter TXOP\_DURATION is less than 512, set to 2x**⎣**(TXOP\_DURATION)/8**⎦**.Otherwise, set to 2x**⎣**(TXOP\_DURATION-512)/128**⎦+**1. |
|  | B20–B2~~4~~ 5 | ~~Disregard~~ TBD | ~~5~~ TBD | ~~Set to all 1s and treat as Disregard.~~ TBD |
|  | ~~B25~~ | ~~Validate~~  | ~~1~~ | ~~Set to 1 and treat as Validate.~~ |
| U-SIG-2 | B0–B1 | PPDU Type And Compression Mode (TBD) | 2 | TBD |
| or  | B2-B15 | TBD | 15 | TBD |
|  | B16–B19 | CRC | 4 | CRC for bits 0–41 of the U-SIG field. Bits 0– 41 of the U-SIG field correspond to bits 0–25 of the U-SIG-1 field followed by bits 0–15 of the U-SIG-2 field. The CRC computation uses the same polynomial as that in 27.3.11.7.3 (CRC computation). |
|  | B20–B25 | Tail | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0. |

**40.3.8.2.1.5.3 Encoding and Modulation**

**Text to be adopted ends here.**

**References:**

[1] 11-24-1322r9: TGbp Motion Dock, Bo Sun (Sanechips)