### IEEE P802.11 Wireless LANs

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| 11ax D0.1 Comment Resolution for Clause 26.3.3, 26.3.14, 26.3.15 | | | | |
| Date: 2016-06-16 | | | | |
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Abstract

This submission proposes resolutions for comments in clause

* 26.3.3 of TGax Draft 0.1 with the CID 1659
* 26.3.14 with CID 493
* 26.3.15 with CID 494

Revisions:

* Rev 0: Initial version of the document.

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax D0.1 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax D0.1 Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 1659 | 75.45 | 26.3.3 | PHY Motion #154 (UL pre-HE-STF preamble is sent only on the 20MHz- CH(s) where the HE modulated fields are located.) was approved but no corresponding spec text is present in the draft | TBD | Revised –  Modify clause 26.3.3 as indicated in the proposed text changes part in this document (11-16-xxxx-00). |
| 493 | 158.30 | 26.3.14 | it would need to be clarifed the follwing text '(TBD: MCS0-DCM)' | as commented. | Revised –  Add contents in section 26.3.14 as indicated in the proposed text changes part in this document (11-16-xxxx-00). |
| 494 | 158.32 | 26.3.15 | it would need to be clarifed the follwing text '(TBD: MCS0-DCM)' | as commented. | Revised –  Add contents in section 26.3.15 as indicated in the proposed text changes part in this document (11-16-xxxx-00). |

**Discussion:** *None.*

**Propose:**

Revised for 1659, 493, 494.

***TGax editor: Modify the Paragraphs on section 26.3.3 as the following for CID 1659:***

***Change the caption of figure 26-5 and figure 26-6 as following:***



Figure 26‑5 - Transmitter block diagram for the L-SIG, RL-SIG and HE-SIG-A fields of HE SU PPDU, HE MU PPDU and HE extended range SU PPDU when the Beam Change field is 1



Figure 26‑6 – Transmitter block diagram for the L-SIG, RL-SIG and HE-SIG-A fields of HE SU PPDU, HE MU PPDU and HE extended range SU PPDU when the Beam Change field is 0

***Add the following paragraph and figure after Figure 26-6:***

Figure 26‑7 shows the transmit process for the L-SIG, RL-SIG and HE-SIG-A fields of HE trigger-based PPDU using one frequency segment. In the HE trigger-based PPDU, the pre-HE-STF preamble, which includes legacy preamble, RL-SIG and HE-SIG-A, is sent only on the 20 MHz channels where the HE modulated fields are located. When the HE modulated fields are located in more than one 20MHz channel, the pre-HE-STF preamble shall be duplicated over the multiple 20 MHz channels. The following exception applies for the transmit process in Figure 26-7:

* The BCC encoder and interleaver are not used when generating the L-STF and L-LTF fields.



Figure 26‑7 - Transmitter block diagram for the L-SIG, RL-SIG and HE-SIG-A fields of HE trigger-based PPDU.

***TGax editor: Add the Paragraphs on section 26.3.14 as the following for CID 493:***

**26.3.14 HE transmit procedure**

There are five options for the transmit PHY procedure. The first four options, for which typical transmit procedures are shown in Figure 26-36 PHY transmit procedure for an HE\_SU format PPDU, Figure 26-37 PHY transmit procedure for an HE\_MU format PPDU, Figure 26-38 PHY transmit procedure for an HE\_EXT\_SU format PPDU, and Figure 26-39 PHY transmit procedure for an HE\_TRIG format PPDU, are selected if the FORMAT field of the PHY-TXSTART.request(TXVECTOR) primitive is equal to HE\_SU, HE\_MU, HE\_EXT\_SU, or HT\_TRIG, respectively. These transmit procedures do not describe the operation of optional features, such as DCM and TBDs.

The fifth option is to follow the transmit procedure in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) if the FORMAT parameter of the PHYTXSTART.request(TXVECTOR) primitive is NON\_HT and the NON\_HT\_MODULATION parameter is set to NON\_HT\_DUP\_OFDM except that the signal referred to in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) is instead generated simultaneously on each of the 20 MHz channels that are indicated by the CH\_BANDWIDTH parameter as defined in 26.3.9 (HE preamble) and 26.3.11 (Non-HT duplicate transmission).

NOTE 1—For a HE\_MU PPDU the A-MPDU is per user in the MAC sublayer and the HE Training Symbols, and Data are per user in the PHY in Figure 26-37 PHY transmit procedure for an HE\_MU format PPDU, with the number HE Training Symbols depending on the maximum total number of space-time streams across all RUs.

NOTE 2—The transmit procedure for NON\_HT, HT\_MF, HT\_GF, and VHT format are specified in 26.2.x (Support for NON-HT, HT, and VHT formats).



**Figure 26-36 PHY transmit procedure for for an HE\_SU format PPDU**



**Figure 26-37 PHY transmit procedure for an HE\_MU format PPDU**



**Figure 26-38 PHY transmit procedure for an HE\_EXT\_SU format PPDU**



**Figure 26-39 PHY transmit procedure for an HE\_TRIG format PPDU**

In all options, in order to transmit data, the MAC generates a PHY-TXSTART.request primitive, which causes the PHY entity to enter the transmit state. Further, the PHY is set to operate at the appropriate frequency through station management via the PLME, as specified in 26.4 (HE PLME). Other transmit parameters, such as HE-MCS Coding types and transmit power, are set via the PHY-SAP using the PHYTXSTART.request(TXVECTOR) primitive, as described in 26.2.2 (TXVECTOR and RXVECTOR parameters). The remainder of the clause applies to the first four options.

The PHY indicates the state of the primary channel and other channels (if any) via the PHY-CCA.indication primitive (see 22.3.18.5(CCA sensitivity) and 7.3.5.12 (PHY-CCA.indication)). Transmission of the PPDU shall be initiated by the PHY after receiving the PHY-TXSTART.request(TXVECTOR) primitive. The TXVECTOR elements for the PHY-TXSTART.request primitive are specified in Table 26-1 (TXVECTOR and RXVECTOR parameters).

Transmission of the PHY preamble may start if TIME\_OF\_DEPARTURE\_REQUESTED is false, and shall start immediately if TIME\_OF\_DEPARTURE\_REQUESTED is true, based on the parameters passed in the PHY-TXSTART.request primitive.

If all of the following conditions are met:

* if dot11TODImplemented and dot11TODActivated are true or if dot11TimingMsmtActivated is true,
* the TXVECTOR parameter TIME\_OF\_DEPARTURE\_REQUESTED is true,

then the PHY shall issue a PHY-TXSTART.confirm(TXSTATUS) primitive to the MAC, forwarding the TIME\_OF\_DEPARTURE corresponding to the time when the first frame energy is sent by the transmitting port and TIME\_OF\_DEPARTURE\_ClockRate parameter within the TXSTATUS vector. If dot11TimingMsmtActivated is true, then the PHY shall forward the value of TX\_START\_OF\_FRAME\_OFFSET in TXSTATUS vector.

After the PHY preamble transmission is started, the PHY entity immediately initiates data scrambling and data encoding. The encoding method for the Data field is based on the FEC\_CODING, CH\_BANDWIDTH, NUM\_STS, STBC, MCS, and NUM\_USERS parameter of the TXVECTOR, as described in 26.3.2 (HE PPDU format).

The SERVICE field and PSDU are encoded as described in 26.3.3 (Transmitter block diagram). The data shall be exchanged between the MAC and the PHY through a series of PHY-DATA.request(DATA) primitives issued by the MAC, and PHY-DATA.confirm primitives issued by the PHY. PHY padding bits are appended to the PSDU to make the number of bits in the coded PSDU an integral multiple of the number of coded bits per OFDM symbol.

Transmission can be prematurely terminated by the MAC through the PHY-TXEND.request primitive. PSDU transmission is terminated by receiving a PHY-TXEND.request primitive. Each PHYTXEND.request primitive is acknowledged with a PHY-TXEND.confirm primitive from the PHY.

A packet extension and/or a signal extension may be present in the PPDU. When no packet extension and signal extension are present, the PHY-TXEND.confirm primitive is generated at the end of last symbol of the PPDU. When a packet extension and/or a signal extension present, the PHY-TXEND.confirm primitive is generated at the end of the packet extension or signal extension.

In the PHY, the GI with GI duration indicated in GI\_TYPE parameter of the TXVECTOR is inserted in every data OFDM symbol as a countermeasure against delay spread.

When the PPDU transmission is completed the PHY entity enters the receive state.

A typical state machine implementation of the transmit PHY for an HE PPDU transmission is provided in

Figure 26-40 PHY transmit state machine for an HE PPDU transmission. Request (.request) and confirmation(.confirm) primitives are issued once per state as shown. This state machine does not describe the operation of optional features, such as DCM and TBDs.



Figure 26-40 PHY transmit state machine for an HE PPDU transmission

***TGax editor: Add the Paragraphs on section 26.3.15 as the following for CID 494:***

26.3.15 HE Receive Procedure

Typical PHY receive procedures are shown in Figure 26-41 (PHY Receive procedure for a HE\_SU PPDU preamble), Figure 26-42 (PHY Receive procedure for a HE\_EXT\_SU PPDU preamble), 26-43 (PHY Receive procedure for a HE\_MU PPDU preamble), and Figure 26-44 (PHY Receive procedure for a HE\_TRIG PPDU preamble) respectively. A typical state machine implementation of the receive PHY is given in Figure 26-45 (PHY receive state machine). This receive procedure and state machine do not describe the operation of optional features, such as DCM and TBDs. If the detected format indicates a NON\_HT PPDU, refer to the receive procedure and state machine in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification). If the detected format indicates an HT PPDU format, refer to the receive procedure and state machine in Clause 19 (High Throughput (HT) PHY specification). If the detected format indicates a VHT PPDU format, refer to the receive procedure and state machine in Clause 21 (Very High Throughput (VHT) PHY specification).Through station management (via the PLME) the PHY is set to the appropriate frequency, as specified in 26.4 (HE PLME). The PHY has also been configured with cell identification information and STA identification information (i.e., BSS Color value and STA ID in the cell) so that it can receive data intended for the STA in the specific cell. Other receive parameters, such as RSSI and indicated DATARATE, may be accessed via the PHY-SAP.

Upon receiving the transmitted PHY preamble overlapping the primary 20 MHz channel in a greater than or equal to 20 MHz BSS, the PHY measures a receive signal strength. This activity is indicated by the PHY to the MAC via a PHY-CCA.indication primitive. A PHY-CCA.indication(BUSY, channel-list) primitive is also issued as an initial indication of reception of a signal as specified in 22.3.18.5 (CCA sensitivity). The channel-list parameter of the PHYCCA.indication primitive is absent when the operating channel width is 20 MHz. The channel-list parameter is present and includes the element primary when the operating channel width is 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz.

The PHY shall not issue a PHY-RXSTART.indication primitive in response to a PPDU that does not overlap the primary channel, except when the PHY at an AP receives the HE-trigger based PPDU. In such case, the PHY shall issue a PHY-RXSTART.indication primitive in response to a PPDU transmission either at the primary or at the secondary channel.

The PHY includes the most recently measured RSSI value in the PHY-RXSTART.indication(RXVECTOR) primitive issued to the MAC. The RSSI measurement for HE-trigger based PPDU is TBD.

After the PHY-CCA.indication(BUSY, channel-list) primitive is issued, the PHY entity shall begin receiving the training symbols and searching for the preambles for NON-HT, HT, VHT, and HE PPDUs, respectively. If the constellation used in the first symbol after the first long traing field is QBPSK, the PHY entity shall continue to detect the received signal using the receive procedure for HT-GF depicted in Clause 19. Otherwise, for detecting the HE preamble, the PHY entity shall search for L-SIG and RL-SIG in order to set the maximum duration of the data stream. If RL-SIG is detected, the PHY entity should check the parity bit and RATE fields in L-SIG and RL-SIG. If either the check of the parity bit is invalid or the RATE field is not set to MCS0 in NON-HT, a PHY-RXSTART.indication primitive is not issued. If the check of the parity bit is valid and the RATE field is set to MCS0 but the LENGTH field value in L-SIG is a multiple of 3, a PHY-RXSTART.indication primitive is not issued. In both cases, the PHY should continue to detect the received signal using NON\_HT, HT, and VHT receive procedure in Clauses 17, 19, and 21, respectively.

If a valid parity bit and the RATE with MCS0 are indicated in L-SIG and RL-SIG and the LENGTH field value in L-SIG and RL-SIG meet the condition that the remainder is 1 after LENGTH divided by 3, the PHY entity should begin receiving the sequence of HE-SIG-A, HE-STF, and HE-LTF for HE\_SU PPDU and HE\_TRIG PPDU as shown in Figure 26-41 and Figure 26-44, respectively. After RL-SIG, the PHY entity shall receive two symbols of HE-SIG-A immediately followed by HE-STF. The PHY entity shall check CRC of HE-SIG-A. If the CRC check is valid, the PHY entity shall report TXOP, BSS Color and check Format field, and continue to receive HE-STF. The PHY entity shall report to the MAC entity the predicted duration of the TXOP in HE-SIG-A. The PHY entity shall check the BSS color in HE-SIG-A. If the BSS color doesn’t contain an intended value, the PHY entity shall set PHY\_RXSTART.indication(RXVECTOR) then set PHY\_RXEND.indication(Filtered). The PHY entity shall check Format field in HE-SIG-A. If the Format field indicates HE\_SU PPDU, the PHY entity shall receive HE-STF for 4 µs after HE-SIG-A. If the Format field indicates HE\_TRIG PPDU, the PHY entity shall receive HE-STF for 8 µs after HE-SIG-A. The PHY entity shall maintain PHY-CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU, as defined by RXTIME in Equation (21-106), for all supported modes, unsupported modes, Reserved HE-SIG-A Indication, and invalid HE-SIG-A CRC. Reserved HE-SIG-A Indication is defined as an HE-SIG-A with Reserved bits equal to 0 or TBD. If the HE-SIG-A indicates an unsupported mode, the PHY shall issue a PHY-RXEND.indication(UnsupportedRate)primitive. If the HE-SIG-A indicates an invalid CRC or Reserved HE-SIG-A Indication, the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation)primitive.

If a valid parity bit of L-SIG and RL-SIG is indicated and the LENGTH field value in L-SIG and RL-SIG meet the condition that the remainder is 2 after LENGTH divided by 3, the PHY entity should detect the signal constellations in the second symbol after RL-SIG. If the constellation is QBPSK, the PHY entity shall continue receiving the sequence of HE-SIG-A, HE-STF, and HE-LTF for HE\_EXT\_SU PPDU shown in Figure 26-42. After RL-SIG, the PHY entity shall receive four symbols of HE-SIG-A immediately followed by HE-STF. The PHY entity shall check CRC of HE-SIG-A. If the CRC check is valid, the PHY entity shall report TXOP, BSS Color, and continue to receive HE-STF. The PHY entity shall report to the MAC entity the predicted duration of the TXOP in HE-SIG-A. The PHY entity shall check the BSS color in HE-SIG-A. If the BSS color doesn’t contain an intended value, the PHY entity shall set PHY\_RXSTART.indication(RXVECTOR) then set PHY\_RXEND.indication(Filtered). The PHY entity shall receive HE-STF for 4 µs after HE-SIG-A. The PHY entity shall maintain PHY-CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU, as defined by RXTIME in Equation (21-106), for all supported modes, unsupported modes, Reserved HE-SIG-A Indication, and invalid HE-SIG-A CRC. Reserved HE-SIG-A Indication is defined as an HE-SIG-A with Reserved bits equal to 0 or TBD. If the HE-SIG-A indicates an unsupported mode, the PHY shall issue a PHY-RXEND.indication(UnsupportedRate)primitive. If the HE-SIG-A indicates an invalid CRC or Reserved HE-SIG-A Indication, the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation)primitive.

If a valid parity bit of L-SIG and RL-SIG is indicated and the LENGTH field value in L-SIG and RL-SIG meet the condition that the remainder is 2 after LENGTH divided by 3, the PHY entity should detect the signal constellations in the second symbol after RL-SIG. If the constellation is BPSK, the PHY entity shall continue receiving the sequence of HE-SIG-A, HE-SIG-B, HE-STF, and HE-LTF for HE\_MU PPDU shown in Figure 26-43. After RL-SIG, the PHY entity shall receive two symbols of HE-SIG-A immediately followed by HE-SIG-B. The PHY entity shall check CRC of HE-SIG-A. If the CRC check is valid, the PHY entity shall report TXOP, BSS Color, and continue to receive HE-SIG-B. The PHY entity shall report to the MAC entity the predicted duration of the TXOP in HE-SIG-A. The PHY entity shall check the BSS color in HE-SIG-A. If the BSS color doesn’t contain an intended value, the PHY entity shall set PHY\_RXSTART.indication(RXVECTOR) then set PHY\_RXEND.indication(Filtered). After HE-SIG-A, the PHY entity shall receive HE-SIG-B for the number of symbols predicted from HE-SIG-A. If the common field presents in HE-SIG-B, the PHY entity shall check the CRC of the common field. If the CRC in the common field is valid or the commond field is not present, the PHY entity shall search for intended STA-ID in each user-specific subfield with a valid CRC. If no CRC is valid or no intended STA-ID is detected, the PHY entity shall set PHY\_RXSTART.indication(RXVECTOR) then set PHY\_RXEND.indication(Filtered). If a complete allocation of an intended STA-ID is detected in block with valid CRC, the PHY entity shall continue receiving HE-STF for 4 µs after HE-SIG-B for the detected and intended STA. The PHY entity shall maintain PHY-CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU, as defined by RXTIME in Equation (26-114), for all supported modes, unsupported modes, Reserved HE-SIG-A Indication, and invalid HE-SIG-A CRC. Reserved HE-SIG-A Indication is defined as an HE-SIG-A with Reserved bits equal to 0 or TBD. If the HE-SIG-A indicates an unsupported mode, the PHY shall issue a PHY-RXEND.indication(UnsupportedRate)primitive. If the HE-SIG-A indicates an invalid CRC or Reserved HE-SIG-A Indication, the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation)primitive.

If signal loss occurs during reception prior to completion of the PSDU reception, the error condition PHYRXEND. indication(CarrierLost) shall be reported to the MAC. After waiting for the end of the PPDU as determined by Equation (26-114) the PHY shall set the PHY-CCA.indication (IDLE) primitive and return to the RX IDLE state.

 (26-114)

Signal Extension is 0 μs when TXVECTOR parameter NO\_SIG\_EXTN is true and is aSignalExtension as defined in Table xxx of 26.3.x (HE PHY) when TXVECTOR parameter NO\_SIG\_EXTN is false.

Except HE NDP, a data field follows HE-STF and HE-LTF.(#728) The number of symbols in Data field is determined by (26-115) for HE SU PPDU and HE Trigger-based PPDU.

 (26-115)

The number of symbols in Data field is determined by (26-116) for HE Extended Range SU PPDU.

 (26-116)

The number of symbols in Data field is determined by (26-117) for HE MU PPDU.

 (26-117)

The PE field duration is determined by (26-118) for HE SU PPDU and HE Trigger-based PPDU.

 (26-118)

The PE field duration is determined by (26-119) for HE Extended Range SU PPDU.

 (26-119)

The PE field duration is determined by (26-120) for HE MU PPDU.

(26-120)

where

is the LENGTH field in L-SIG;

 indicates PE disambiguity in packet extension field in HE-SIG-A.

The received PSDU bits are assembled into octets, decoded, and present to the MAC using a series of PHY-DATA.indication(DATA) primitive exchanges. Any final bits that cannot be assembled into a complete octet are considered pad bits and discarded. After the reception of the final bit of the last PSDU octet, and possible padding and tail bits, the PHY entity shall check whether packet extension and/or signal extension is applied. If packet extension and/or signal extension is applied, the PHY entity shall wait until the packet extension and/or signal extension expires before returning to the RX IDLE state, as shown in Figure 26‑45.

**The receiving procedures are subject to further changes depending on the decisions of spatial reuse.**

**Figure 26-41—PHY Receive procedure for HE\_SU PPDU.**

 **Figure 26-42—PHY Receive procedure for HE\_EXT\_SU PPDU.**

 **Figure 26-43—PHY Receive procedure for HE\_MU PPDU.**



**Figure 26-44—PHY Receive procedure for HE\_TRIG PPDU.**



Figure 26-45—PHY Receive state machine.