IEEE P802.11
Wireless LANs

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| Enabling HE FTM in 6 Ghz band |
| Date: 2019-06-01 |
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Abstract

This submission proposes enabling HE SU FTM frames in the 6 GHz band.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Incorporated feedback received during the presentation and updated the co-author list. Changes highlighted in green.
* Rev 2: Incorporated feedback received offline from Liwen. STA can request peer STA to use EDCA-based FTM if the STA does not support NDP ranging. Changes in this color.
* Rev 3: Minor bug fixes. Changes in this color.
* Rev 4: Incorporated feedback received during the second presentation. Changes in this color.
* Rev 5: Updated author list. No technical changes.

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 TGaz Draft. This introduction is not part of the adopted material.

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

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

**Discussion: *This document proposes enabling EDCA-based FTM transmissions in the 6 GHz band using the HE SU PPDU format.***

**9.4.2.167 Fine Timing Measurement Parameters element**

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| ***TGaz editor: Insert new rows in table 9-281 as follows:***Table 9-281 Format And Bandwidth field |
| Field value | Format | Bandwidth (MHz) |
| … | … | … |
| 17 | HE | 20 |
| 18 | HE | 40 |
| 19 | HE | 80 |
| 20 | HE | 80+80 |
| 21 | HE (two separate RF LOs) | 160 |
| 22 | HE (single RF LO) | 160 |
| 23 | EDCA-based HE  | 20 |
| 24 | EDCA-based HE | 40 |
| 25 | EDCA-based HE | 80 |
| 26 | EDCA-based HE  | 80+80 |
| 27 | EDCA-based HE (two separate RF LOs) | 160 |
| 28 | EDCA-based HE (single RF LO) | 160 |
| 29-30 | Reserved | Reserved |
| 31 | DMG | 2160 |
| … |  |  |

**11.22.6.3 Fine timing measurement procedure negotiation**

***TGaz editor: Change the paragraphs below of this subclause as follows:***

The initiating STA shall indicate, in the Format and Bandwidth field, a format and bandwidth that it supports. The initiating STA shall indicate an EDCA-based HE format in the Format And Bandwidth field sent to a responding STA if and only if the STAs are operating in the 6 GHz band, at least one of the STAs does not support TB or non-TB ranging, and the responding STA has sent an Extended Capabilities element with the Fine Timing Measurement Responder subfield set to 1; otherwise the STA shall not indicate an EDCA-based HE format in the Format And Bandwidth field. A STA that supports TB or non-TB ranging is not required to support EDCA-based HE.

If the request was successful

* The responding STA shall indicate, in the Format and Bandwidth field, a format and bandwidth that it supports. The responding STA should indicate the same format and bandwidth in the Format and Bandwidth field as that requested by the initiating STA, if the responding STA supports this. The responding STA shall not indicate a bandwidth wider than requested. The responding STA shall not indicate a VHT format if DMG, HT-mixed or non-HT format was requested. The responding STA shall not indicate an HT format if DMG or non-HT format was requested. The responding STA shall not indicate a DMG format if VHT, HT-mixed or non-HT format was requested. The responding STA shall indicate EDCA-based HE format only if EDCA-based HE was requested (see 26.17.2) and the STA is operating in the 6 GHz band; otherwise the STA shall not indicate EDCA-based HE format.

**26.15.2 PPDU format selection**

***TGaz editor: Change the paragraph below of this subclause as follows:***During an EDCA FTM session, an HE STA should send an Ack frame in the same PPDU format as the soliciting PPDU when the soliciting PPDU a VHT PPDU or HT PPDU containing an FTM frame and shall send the Ack frame in the HE SU PPDU format when the soliciting PPDU is an HE SU PPDU containing an FTM frame (see 26.17.2 (HE BSS operation in the 6 GHz band)).

**26.17.2 HE BSS operation in the 6 GHz band**

**26.17.2.1 General**

***TGaz editor: Insert a new paragraph after the paragraph below of this subclause as follows:***A STA shall not transmit an HT PPDU in the 6 GHz band. A STA shall not transmit a VHT PPDU in the 6 GHz band. A STA shall not transmit a DSSS, HR/DSSS, or ERP-OFDM PPDU in the 6 GHz band.

When an HE STA negotiates an FTM session, as defined in 11.22.6 (Fine timing measurement (FTM) procedure), the STA shall set the Format And Bandwidth field to a value that corresponds to either HE or EDCA-based HE format (see Table 9-282 (Format and Bandwidth field)) in the initial Fine Timing Measurement Request frame for the ISTA, and in the initial Fine Timing Measurement frame for the RSTA, that it transmits in the 6 GHz band. An HE STA that negotiates an EDCA FTM session shall transmit Fine Timing Measurement frame in an HE SU PPDU and Fine Timing Measurement Request frame in a non-HT PPDU, or an HE SU PPDU.

**27.3.20 HE transmit procedure**

***TGaz editor: Insert the following paragraphs after the 4th paragraph of this subclause:***

The PHY indicates the state of the primary channel and other channels (if any) via the PHY-CCA.indication primitive (see 21.3.18.5 (CCA sensitivity) and 8.3.5.12 (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 27-1 (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.

**27.2.2 TXVECTOR and RXVECTOR parameters**

***TGaz editor: Insert the row below in Table 28-1 as follows:***

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| --- |
| Table 27-1 -- TXVECTOR and RXVECTOR parameters  |
| Parameter | Condition | Value | TXVECTOR | RXVECTOR |
|  | (…existing fields…) |
| TIME\_OF\_DEPARTURE\_REQUESTED | Format is HE\_SU | Enumerated type:True indicates that the MAC entity requests that the PHY entity measures and reports time of departure parameters corresponding to the time when the first frame energy is sent by the transmitting port. False indicates that the MAC entity requests that the PHY entity neither measures nor reports time of departure parameters. | O | N |
| Format is HE\_ER\_SU, HE\_MU or HE\_TB | Not present | N | N |
| Otherwise | See corresponding entry in Table 21-1. |  |  |
| RX\_START\_OF\_ FRAME\_OFFSET | See corresponding entry in Table 21-1 (TXVECTOR and RXVECTOR parameters). |
|  | … |

***TGax editor: Insert a new subclause as follows:***

27.3.18a Time of departure accuracy

The Time of Departure accuracy test evaluates TIME\_OF\_DEPARTURE against aTxPHYTxStartRMS and aTxPHYTxStartRMS against TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH as defined in Annex P with the following test parameters:

* MULTICHANNEL\_SAMPLING\_RATE is:

 sample/s, for a CH\_BANDWIDTH parameter equal to CBW20

 sample/s, for a CH\_BANDWIDTH parameter equal to CBW40

 sample/s, for a CH\_BANDWIDTH parameter equal to CBW80

 sample/s, for a CH\_BANDWIDTH parameter equal to CBW160 or CBW80+80

where

*fH* is the nominal center frequency in Hz of the highest channel in the channel set

*fL* is the nominal center frequency in Hz of the lowest channel in the channel set, the channel set is the set of channels upon which frames providing measurements are transmitted, the channel set comprises channels uniformly spaced across.

* FIRST\_TRANSITION\_FIELD is L-STF.
* SECOND\_TRANSITION\_FIELD is L-LTF.
* TRAINING\_FIELD is L-LTF windowed in a manner which should approximate the windowing described in 17.3.2.5 (Mathematical conventions in the signal descriptions) with TTR = 100 ns.
* TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH is 80 ns.

NOTE—The indicated windowing applies to the time of departure accuracy test equipment, and not the transmitter or receiver.