IEEE P802.11
Wireless LANs

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| CR for Clause 4 |
| Date: 2018-11-05 |
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Abstract

This document provides CR for CIDs related to 15153, ~~15161~~, 16335, 16387, 16388, 16549, 16640, 16642, 17002, 17049, 17050, 17051.

1. **Introduction**

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 Draft. The introduction and the explanation of the proposed changes are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax 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** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 17002 | Yasuhiko Inoue | 41.14 | 4.3.14a | "An HE STA that is a mesh STA does not transmit and does not receive HE TB PPDUs."I do not understanda why this restriction is needed. | Remove this sentence. |  Reject. Currently only AP is sending trigger frame to solicit UL OFDMA transmssoin. Since mesh STA has no AP role, it cannot do UL OFDMA. o support UL OFDMA in mesh, a lot of technical details need to be defined, for example, capability indication of “AP” vs. “STA” role in UL OFDMA operation, BSS color selection in SIG-A content. Therefore we have this restriction. |
| 15161 | Albert Petrick | 41.16 | 4.3.14a | In the (HE) STA clause 4.3.14a -- it states the HE STA operates in the bands between 1 GHz and 7.125 GHz. The 6 GHz band may use the existing channel BWs as in the 5 GHz band. BW (20, 40, 80 and 160 MHz). If the TG goal is to include the 6 GHz band option with specifications in the final ammendment, the draft should be updated while the TG and WG is developing the specification and working with the regulatory bodies e.g., FCC For some parameters the specifications may be the same as what's used for the 5 GHz band. | Update the various PHY clauses text to include the 6 GHz band specifications such as:28.3.18.3 Transmit center frequency and symbol clock frequency toleranceTable 28-44--Transmit power and RSSI measurement accuracy28.3.19.5 Receiver maximum input level28.3.18.1 Transmit spectral mask |  Reject. The commenter did not provide the corresponding spec text for the proposed resolution. |
| 16335 | Mark RISON | 41.17 | 4.3.14a | An HE STA cannot be a VHT STA, because a VHT STA is required to support 80M operation, but a 20 MHz-only HE STA is not | Change "An HE STA is also a VHT STA" to say "An HE STA that is not a 20 MHz-only STA is also a VHT STA" |  Revised.HE 20MHz-only STA is also a VHT STA which only supports 20MHz channel bandwidth. However, there is some inconsistency with some text in clause 21.Pplease see the proposed text in #18/1868r5 to clarify this point.TGax editor to make the changes as shown in 11/18/1868r6 |
| 16387 | Massinissa Lalam | 41.18 | 4.3.14a | As far as I know, there is no VHT STA defined in the 6 GHz up to 7.125 GHz band. | Replace "An HE STA is also a VHT STA" with "An HE STA is also a VHT STA when operating in the 5 GHz band". |  Accept. |
| 15153 | Albert Petrick | 41.35 | 4.3.14a | Add definitions for UL OFDMA, UL MU-MIMO, in clause 3.0 DL is covered 802.11-2016 | Change as commented |  RevisedAdd UL/DL OFDMA and UL MU MIMOThere is acrynym defined for OFDMA in 11ax spec and uplink defined in 802.11-2016 (on page 169). There is no need to define UL OFDMA. Proposed resolution clarifies the case of trigger based PPDU which is missing.TGax editor to make the changes as shown in 11/18/1868r6 |
| 16388 | Massinissa Lalam | 41.40 | 4.3.14a | Similar comment I made in D2.0 and I'm not satisfied with the answer provided in D3.0:An HE non-AP STA shall support reception of DL MU-MIMO but may support HE sounding protocol to support beamforming. It seems to me that without beamforming feedback, DL MU-MIMO is highly inefficient. If DL MU-MIMO reception is mandatory for an non-AP-STA, then HE sounding should also be mandatory, otherwise the feature is highly inefficientAs it is clearly stated in subclause 27.6 of D3.0, "Transmit beamforming and DL MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the transmit signal to optimize reception at one or more receivers. HE STAs use the HE sounding protocol to determine the channel state information.". Therefore, if support of DL MU-MIMO reception is mandatory for an non-AP HE STA, then support for the HE sounding protocol to support beamforming SHOULD be mandatory as well. | Replace "Optional support for the HE sounding protocol to support beamforming" with "Mandatory support for the HE sounding protocol to support beamforming" |  Accept. |
| 17051 | Yongho Seok | 41.65 | 4.3.14a | "Optional support for multi-TID A-MPDU operation"Based on 27.10.4 (Multi-TID A-MPDU and ack-enabled A-MPDU), please clarify whether the ack-enabled A-MP∞ù¼ is an optional support or a mandatory support. | As in comment. |  Reject.From section 27.10.4: A multi-TID AMPDU is either a non-ack-enabled multi-TID AMPDU or an ack-enabled multi-TID AMPDU, both are optional, so this bulletin covers both cases correctly. |
| 16549 | Peter Loc | 42.07 |   | AP only targets trigger frame to non-AP HE STAs | Change the first sentence of the paragraph to: "An HE AP sends a Trigger frame to non-AP HE STAs to initiate OFDMA or MU-MIMO transmissions in the uplink direction" |  Accept. |
| 16640 | Robert Stacey | 42.09 | 4.3.14a | The transmission is not acknowledged. It is the frames that solicit acknolwedgement are acknowledged. | Change statement to "An AP may use a Multi-STA BlockAck frame to acknowledge frames from more than one STA that are received in the UL MU transmissions." |  RevisedTGax editor to make the changes as shown in 11/18/1868r6 |
| 17049 | Yongho Seok | 42.10 | 4.3.14a | "Trigger frames can be scheduled by the AP to allow non-AP STAs to save power."Trigger frame itself does not help to save the power.Please remove the cited sentence. | As in comment. |  Revised.Removed this sentence. Instead added some wording to the next sentence on 11ax power saving..TGax editor to make the changes as shown in 11/18/1868r6 |
| 17050 | Yongho Seok | 42.16 | 4.3.14a | In 802.11ax PAR,"Average throughput per station is directly proportional to both aggregate basic service set (BSS) throughput and area throughput. The 5thpercentile measure of the per station throughput may be used to determine that the desired distribution of throughput among a number ofstations in an area is satisfied. These metrics, along with the satisfaction of the packet delay and the packet error ratio (PER) requirements ofapplications, will directly correspond to user experience in identified scenarios."Please add that 802.11ax STA is also helpful to meet the QoS requirement (such as the packet dealy and the packet error ratio). | As in comment. |  Reject.Agree in principle witih the commenter. However, there is no direct mapping from throughput to delay/PER. Packet latency and PER depen on many factors such as congestion levels, MCS, hidden node scenarios etc. Therefore, suggest to keep the original wording. An experienced designer will be able to map these 11ax features into their QoS design requirements. The wording cited by the commenter is in the explanatory note section 8.1, not in the scope section,  |
| 16642 | Robert Stacey | 42.19 | 4.3.14a | Why more than 4 times? Surely the same features might also produce 2 times improvement. Or 3 times imrpovement. What is a VHT? | Change to "These features, under certain circumsances improve the aggregate throughput in an HE BSS compared to a VHT BSS." |  Reject.The four times wording here is to match the PAR requriement that 11ax shll provide 4 times throughput than 11ac. There is also “under circumstatances” to not generalize the 4 times claims to all cases. |

Editor: please add the following definitions to clause 3.

**Triggered-based protocol data unit (PPDU):** A PPDU that carries one or more PHY service data units (PSDUs) from one or more stations (STAs) using the multi-user multiple input, multiple output (MU-MIMO) technique, orthogonal frequency division multiple access (OFDMA) technique, or a combination of the two techniques.(#1513)

**Notes (not to be incorporated into spec): below is the definition of MU PPDU in D3.0:**

**multi-user (MU) physical layer (PHY) protocol data unit (PPDU):** A PPDU that carries one or more PHY service data units (PSDUs) for one or more stations (STAs) using the downlink multi-user multiple input, multiple output (DL-MU-MIMO) technique, downlink orthogonal frequency division multiple access (DL OFDMA) technique, or a combination of the two techniques.

Editor: please modify the following clause as follows:

**4.3.14a High efficiency (HE) STA**

The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 7.125 GHz(#12205).

An HE STA that is a mesh STA does not transmit and does not receive HE TB PPDUs(#12282).

In the 5 to 7.125 GHz bands(#11957), the following apply:

--An HE STA is also a VHT STA when operating in the 5 GHz band(#16387) except that a 20 MHz-only HE STA does not support 40 MHz and 80 MHz channel width (#16335)

--An HE STA shall support operation with a 20 MHz channel width

--An HE STA that is not a 20 MHz-only non-AP STA shall support operation with a 40 MHz and 80 MHz channel width(#11956)

--An HE STA may support operation with a 160 MHz and 80+80 MHz channel width(#11263)

In the 2.4 GHz band, the following apply:

--An HE STA is also an HT STA

--An HE STA shall support operation with a 20 MHz channel width

--An HE STA may support operation with a 40 MHz channel width

The main PHY features in an HE STA that are not present in VHT STA or HT STA are the following:

--Mandatory support for DL and UL OFDMA

--Mandatory support for DL MU-MIMO by an HE AP that supports 4 or more spatial streams when MU-MIMO is done on the entire PPDU bandwidth

--Mandatory support for DL MU-MIMO reception for an non-AP HE STA

--Mandatory support for the HE sounding protocol to support beamforming\*\*

--Optional support for HE-MCSs 10 and 11

--Optional support for UL MU-MIMO

--Optional support for preamble puncturing

The main MAC features in an HE STA that are not present in VHT STA or HT STA(#11264) are the following:

--Optional support for dynamic fragmentation levels 1, 2 and 3

--In an AP, mandatory support for the role of operating mode indication (OMI) responder and optional support for the role of OMI initiator(#13804)

--In a non-AP STA, optional support for the roles of OMI initiator and responder

--In an AP, optional support for two NAV operation

--In a non-AP STA, mandatory support for two NAV operation

--In an AP, mandatory support for individual target wake time (TWT) operation

--In a non-AP STA, optional support individual TWT operation

--Optional support for broadcast TWT(#12350)

--Optional support for UL OFDMA-based random access (UORA)

--Optional support for spatial reuse operation

--Optional support for multi-TID A-MPDU operation

--Optional support for ER BSS

--Mandatory support for multiple BSSID operation in a non-AP STA(#11000)

--Optional support for the NDP feedback report(#12312)

An HE AP sends a Trigger frame to non-AP HE STAs (#16549)to initiate OFDMA or MU-MIMO transmissions in the uplink direction. The Trigger frame identifies non-AP STAs participating in the UL MU transmissions and assigns RUs to these STAs. Multi-STA BlockAck frames can be used by the AP to acknowledge the frames transmitted by the multiple non-AP STAs. (#16640) (#17049). The scheduling of the Trigger frames can be set up between a non-AP STA and the AP using TWT operation to save power and reduce collisions.(#17049)

Among other benefits, different combinations of these HE features can reduce protocol overhead and increase aggregate network throughput (e.g., DL and UL OFDMA, DL/UL MU-MIMO), enhance peak link throughput (e.g, MCS 10, 11), enhance dense network efficiency (e.g., spatial reuse), and/or enhance power conservation (e.g., TWT).(#12119) These HE features provide tools, under certain circumstances, to improve the average throughput per STA by more than four times in a BSS, compared to VHT BSS(#11964).