IEEE P802.11`
Wireless LANs

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| Comment resolutions for section 4, 5 and 27.1 |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D2.0 with the following 30 CIDs:

* 12119, 12120, 12121, 11959, 11964, 12312, 12611, 11958, 12974, 13692, 13803, 12282, 12348, 11107, 11957, 11108, 11785, 11956, 12349, 12975, 11264, 13804, 13805, 12350, 11370, 12978, 11263, 12124, 11071, 11788.

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 Draft. This introduction is 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** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| ~~12119~~ | ~~37.00~~ | ~~The 802.11ax amendment provides new capabilities/features that warrant a more explanative introduction then simply stating a list of the "new" phy/mac features and if the features are mandatory or optional. Therefore adding descriptive text as to what the new capabilities and features of a HE STA are and what the purpose and benefits of these capabilities and features are is warranted. Following the style of VHT in no excuse of not adding descriptive text.~~ | ~~Provide a useful and clear introduction to the new capabilities provided by 802.11ax features, including: 1) the benefits of the of capability (e.g. provides for MU access to lower overhead and reduce congestion in 802.11 BSSs), 2) the features of 802.11ax that will enable this capability (e.g. OFDMA or MU-MIMO), and 3) for capabilities that have multiple features supporting them what the expectation/use for the features that support the capability.~~ | ~~Reject.~~~~The decription of feature benefits is beyond the scope of IEEE specification.~~  |
| 12120 | 37.00 | The 802.11ax amendment provides new capabilities/features that warrant a more explanative introduction then simply stating a list of the "new" phy/mac features and if the features are mandatory or optional. I don't believe that clause 4 is the place for stating if a feature is optional or mandatory. Following the style of VHT in no excuse of not adding descriptive text. | Provide a introduction to the new PHY and MAC features without stating if they are Mandatory or Optional. |  Reject.The decription of feature benefits is beyond the scope of IEEE specification. The specific feature is described in the corresponding sections. There is no need to provide thorough explanation in the general description section. |
| 12121 | 37.00 | the description of the new MAC features do not clearly state why these features were introduce, the text simply implies it. It would be clearer to state why these features are being introduced and then provide some guidance on where in the specification the details of these features can be found. The general description in clause 27, while helpful, should not replace a useful summary of the new features in clause 4. | Insert a paragraph introducing the need/purpose of the new MAC features. |  Reject.The decription of feature benefits is beyond the scope of IEEE specification. |
| 11959 | 37.01 | Instead of changing the term "5 GHz Band" throughout the document add a sentence in the beginning of section 4 (in one of the base document clauses not yet modified in 11ax) to define the "5 GHz Band" as between 5150-7125 MHz. |   |  Revised.Added clarification on the supported band. TGax editor to make changes shown in 11-18/705r2. |
| ~~11964~~ | ~~37.10~~ | ~~The stated scope in the ax PAR of "at least one mode of operation capable of supporting at least four times improvement in the average throughput per station" still needs to be met. A description of such performance improvement should be added to this subclause.~~ | ~~As suggested.~~ | ~~Reject.~~~~The decription of feature benefits is beyond the scope of IEEE specification.~~ |
| 12312 | 37.10 | The list of PHY and MAC features is not complete and should be extended. | Extend the list of PHY and MAC features. For instance, NDP feedback report is not indicated. |  Revised.Agree in principle. TGax editor to make changes shown in 11-18/705r2. |
| 12611 | 37.11 | With the recent PAR change, the upper operating range is now 7.125 GHz | Change "6 GHz" to "7.125 GHz" on pages 2, 4 and 37 |  Accept.TGax editor to make changes shown in 11-18/705r2. |
| 11958 | 37.12 | Raise the upper limit | The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 8 GHz. |  Revised.Modified 6GHz to 7.125GHz as specified in PAR.TGax editor to make changes shown in 11-18/705r2. |
| 12974 | 37.12 | PAR covers up to 7.125 GHz, frequency bands should reflect it. | Replace "The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 6 GHz." with "The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 7.125 GHz.". |  Accept.TGax editor to make changes shown in 11-18/705r2. |
| 13692 | 37.12 | Now the PAR also covers the 6 GHz band. | Change the sentence from "The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 6 GHz." to "The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 7.125 GHz." |   Accept.TGax editor to make changes shown in 11-18/705r2. |
| 13803 | 37.12 | "The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 6 GHz."6 GHz should be changed to 7.125 GHz. | As in the comment. |   Accept.TGax editor to make changes shown in 11-18/705r2. |
| 12282 | 37.14 | "An HE STA that is a mesh STA does not transmit and does not receive HE MU PPDUs or HE TB PPDUs." sounds to be too restrictive. Some features based on TF should be beneficial for mesh STAs. | Please consider to allow use of HE MU PPDUs and some of the HE TB PPDUs for mesh STAs. |  Revised.HE MU PPDU can be sent from non-AP STA and should be allowed for mesh STAs. However, HE TB PPDU currently is not allowed to be sent by non-AP STA. If the commenter wants to enable such mode, please bring a proposal. TGax editor to make changes shown in 11-18/705r2. |
| 12348 | 37.14 | HE MU PPDU should be able to be transmitted in mesh link since HE MU PPDU can be from non-AP STA to AP, from STA to STA, from AP to STAs. | Remove the restriction of HE MU PPDU here. |  Revised.Agree in principle. TGax editor to make changes shown in 11-18/705r2. |
| 11107 | 37.16 | "In the 5 GHz band, the following apply:-- An HE STA is also a VHT STA-- An HE STA shall support operation in 20 MHz channel width"But a VHT STA is required to support 20 MHz operation, so the second dash item is unnecessary. | Remove second dash item |  Revised.The support of 20 MHz is mandatory for all HE STAs. Revised to add some clarification. TGax editor to make changes shown in 11-18/705r2. |
| 11957 | 37.17 | Change to 5 GHz and 6 GHz bands | In the 5 GHz and 6 Ghz bands, the following apply: | Revised Modified to “In the 5 to 7.125 GHz” to be consistent with PAR.TGax editor to make changes shown in 11-18/705r2. |
| 11108 | 37.21 | "An HE STA shall support operation in 40 MHz and 80 MHz channelwidth unless the STA indicatesthat it only supports 20 MHz channel width"But an HE STA is a VHT STA, and the baseline states "The main PHY features in a VHT STA that are not present in an HT STA are the following:-- Mandatory support for 40 MHz and 80 MHz channel widths"This creates an issue because if a VHT STA talks to an HE STA that only supports 20 MHz channel width, it has no way of knowing that restriction. It also creates a contradiction in the standard. | Do one of the following:1. Make HE a strict superset of VHT operation - i.e. remove the 20 MHz-only mode.2. Alternatively remove the inheritance of VHT features in 5 GHz, and only extend 802.11a.3. Alternatively create "protection" or "exclusion" rules that will prevent a non-HE VHT STA from talking directly to a 20-MHz-only HE STA; such might include creating a BSS Membership selector to exclude non-HE VHT STAs from a BSS where 20 MHz only mode is permitted, or only allowing 20 MHz only STAs to join a BSS of 20 MHz operating width. |  Reject.Spec has specified rules how 20MHz-only STA report its capability and how OMN is used to notify the peer STA that it only support 20MHz bandwidth. So the problem described in the comment is resolved in current spec. |
| 11785 | 37.21 | "An HE STA shall support operation in 40 MHz and 80 MHz channel width unless the STA indicates that it only supports 20 MHz channel width" Hmm...does it or does it not? Surely this is simply "may support 40 MHz and 80 MHz"? | Replace cited text with "An HE STA may support operation in 40 MHz and 80 MHz channel width" |  Reject.May support 40 and 80MHz will make 40 and 80 completely optional for all STAs. However, non 20MHz-only HE STA is required to support 40 and 80MHz.  |
| 11956 | 37.21 | I see the term "20MHz-only non-AP STA" defined later on in the document which might help clarify this otherwise confusing list of requirements. As it reads now, the part that follows "unless the STA indicates..." is not using technical enough terms to trace the requirements to the specification | An 20MHz-only HE STA shall support operation in 20 MHz channel width. All other HE STA shall support operation in 20, 40 and 80 MHz channel widths. |  Acccpet.TGax editor to make changes shown in 11-18/705r2. |
| 12349 | 37.39 | Add "when MU-MIMO is done on the entire PPDU bandwidth" | As in comment |  RejectCurrent text is accurate on the spec requirement on DL MU MIMO. |
| 12975 | 37.39 | 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 broken or its reception should be optional for a non-AP HE STA. | Either have both "support for DL MU-MIMO reception for an non-AP HE STA" and "support for the HE sounding protocol to support beamforming" mandatory or both optional. |  Reject.The support of sounding protocol and the relationship with BW and # of spatial streams are specifiec in 27.6. There is no need to bundle the support of sounding with DL MU MIMO in the geneal description section.  |
| 11264 | 37.48 | Features are not present for both AP and non-AP. | Remove "non-AP" |  Accept.TGax editor to make changes shown in 11-18/705r2. |
| 13804 | 37.51 | "Mandatory support for an AP to receive and optional an AP to transmit operating mode indication"This sentence can be improved. | Mandatory support for an AP to receive operating mode indication (OMI). Transmission of OMI is optional for AP. |  Revised.Editorial changes. TGax editor to make changes shown in 11-18/705r2. |
| 13805 | 37.54 | "Mandatory support for a non-AP STA and optional support for an AP for two NAV operation"Two NAV operation should be mandatory for both non-AP STA and AP. | As in the comment. |  Reject.The spec does not mandage two NAV for AP, so no changes are needed. |
| 12350 | 37.57 | Broadcast TWT is optional to AP | Changethe bullet per the comment. |  Revised.Added “individual’ to clarify and optional support for broadcast TWT. TGax editor to make changes shown in 11-18/705r2. |
| 11370 | 38.01 | Random access is a key feature introduced by TGax. It should be mentioned in the paragraph describing new features belonging to an HE STA. | As in comment |  Reject.There are many features that can be described. However, this is a general description section and there is no need to provide description for every feature. |
| 12978 | 38.25 | Is it useful in this particular case to add the HE precision for the BSS color collision event? If the feature is not supported by a non HE STA, then it is more than likely that an AP would not request it and even if it does it would be discarded by the STA. It allows other (future) amendments that may use BSS color to use this event without modifying this section. | Replace "A BSS color collision event report enables a non-AP HE STA to signal BSS color collision to its associated AP." with "A BSS color collision event report enables a non-AP STA to signal BSS color collision to its associated AP." |  Reject.BSS collision report is only supported by 11ax STAs and not by legacy STAs, and thefore the current text correct statement of the support of this feature.  |
| 11263 | 57.65 | Cannot have normative description in clause 4. Suggest to re-word as declarative statements. | As in comment. Applies to both "shall" and "may" statements. |  Revised.Agree in principle. Reword as declarative statement. TGax editor to make changes shown in 11-18/705r2. |
| 12124 |   | I find it hard to believe that given the significant MAC features added in this amendment that there are no changes to clause 5. Are there additions to the Security services with the additional of A-PDU fragmentation? Are there additions needed to the MSDU ordering? | Insert required changes to clause 5 |  Reject.No specific suggestions provided in the comment. |
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| 11071 | 221.12 | "except when the functions in Clause 27 supersede the functions in Clause 10 or Clause 11."How do we know when this happens?229.10: "NOTE 4--The TxOPLimit[AC] state variables are not updated by the procedure defined in this subclause, but in 10.22.2.8 TxOP limit" is not a good model to follow - it should be clearly stated up-front rather than buried in a NOTE. | Describe here the method that indicates that behaviour supersedes an existing clause 10 or clause 11 function. Ensure that that method is used consistencly throughout 27. |  Reject.The intention of this paragraph is that the HE STA supports clause 10, 11 and 27, and if there is a conflict between clause 27 and clause 10 or 11, then clause 27 takes precedence. I think current text reflects this intention |
| 11788 | 221.10 | "An HE STA supports the MAC and MLME functions defined in Clause 27 in addition to the MAC functions defined in Clause 10 and the MLME functions defined in Clause 11, except when the functions in Clause 27 supersede the functions in Clause 10 or Clause 11." Of course an HE STA supports what's in clause 27, that's the point of it. The important point here is that 10 and 11 are also supported but may be superceded. | Replace cited text with "An HE STA supports the MAC and MLME functions defined in Clause 10 and the MLME functions defined in Clause 11, except when the functions in Clause 27 supersede the functions in Clause 10 or Clause 11." |  Reject.The intention of this paragraph is that the HE STA supports clause 10, 11 and 27, and if there is a conflict between clause 27 and clause 10 or 11, then clause 27 takes precedence. I think current text reflects this intention |

**Discussion: *None.***

***Tech editor: modify the first paragraph on page 2 as follows:***

**Abstract**: This amendment defines modifications to both the IEEE 802.11 physical layer (PHY) and the medium access control (MAC) sublayer for high efficiency operation in frequency bands between 1 GHz and 7.125 GHz (#12611. 11959).

***Tech Editor: modify the second paragraph on page 3 as follows:***

This amendment defines modifications to both the IEEE 802.11 physical layer (PHY) and the medium access control (MAC) sublayer for high efficiency operation in frequency bands between 1 GHz and 7.125 GHz (#12611, 11959).

***Tech editor: modify Clause 4 as follows:***

**4. General description**

**4.3 Components of the IEEE Std 802.11 architecture**

***Insert a new subclause after subclause 4.3.14(#7696) 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 (#12611, 11958, 12974, , 11959, 13692, 13803).

An HE STA that is a mesh STA does not transmit and does not receive HE TB PPDUs. (#12282, 12348, 11959)

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

* An HE STA is also a VHT STA
* Support of operation in 20 MHz channel width is mandatory for all HE STAs (#11263)
* Support of operation in 40 MHz and 80 MHz channel width is mandatory for all HE STAs except 20 MHz-only non-AP STA (#11956, 11263)
* Support of operation in 160 MHz and 80+80 MHz channel bandwidth is optional for an HE STA. (#11263)

In the 2.4 GHz band, the following apply:

* An HE STA is also an HT STA
* Support of operation in 20 MHz channel width is mandatory for all HE STAs. (#11263)
* Support of operation in 40 MHz channel width is optional for an HE STA.

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
* Optional 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 are the following (#11264):

* Optional support for dynamic fragmentation levels 1, 2 and 3
* Mandatory support for an AP to receive operating mode indication (OMI) (#13804) and optional an AP to transmit operating mode indication (#13804)
* Optional support for a non-AP STA to transmit and receive for operating mode indication
* Mandatory support for a non-AP STA and optional support for an AP for two NAV operation
* Optional support in a non-AP STA and mandatory support in an AP for individual target wake time (TWT) operation (#12350)
* 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 in a non-AP STA for Multi-BSSID
* Optional support of NDP Feedback Report (12312)

An HE AP sends a Trigger frame 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 transmissions from the multiple non-AP STAs. Trigger frames can be scheduled by the AP to allow non-AP STAs to save power. The scheduling of these Trigger frames can be set up between a non-AP STA and the AP using TWT operation.

***Tech editor: modify Clause 27.1 as follows (no changes now, just to show the text so the group can see and comment during the discussion):***

**27.1 Introduction**

An HE STA supports the MAC and MLME functions defined in Clause 27 in addition to the MAC functions defined in Clause 10 and the MLME functions defined in Clause 11, except when the functions in Clause 27 supersede the functions in Clause 10 or Clause 11.