IEEE P802.11
Wireless LANs

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| Comment Resolutions on Clause 9.4.2.218.3 (HE PHY Capabilities) Part 2 |
| Date: 2017-02-08 |
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Abstract

This submission proposes resolutions for the following 13 comments on 9.4.2.218.3 (HE PHY Capabilities) of TGax D1.0:

3554, 5157, 5786, 5789,

6429, 7558, 8258, 9083,

9114, 8676, 8381, 6074

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: CID 8381 resolution edited.
* Rev 2: 9083 resolution edited.
* Rev 3: 6074 resolution added.
* Rev 4: 5789 resolution edited.
* Rev 5: Editorial improvements.

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** | **Clause Number** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 3554 | 9.4.2.218.3 | 86.31 | Class A STAs are declared "high capability devices" and class B STAs as "low capability devices" This is the only reference in .11axD1.0 to these terms. Class A and class B STAs are defined in sub-clause 28.3.14 (Transmit requirements for an HE trigger-based PPDU). Transmit power accuracy and RSSI measurement accuracy are discussed in detail e.g., Table 28-40. To eliminate ambiguities, "low and high capability devices" should be defined and referenced back to clause 28.3.14. | Add definition for "low and high capability" devices in clause 28.3.14, and add text reference back to clause 28.3.14.Add underline text (without the underline) to read: "Class A STAs are high capability devices and class B STAs are low capability devices as described in 28.3.14 (Transmit requirements for an HE trigger-based PPDU). | Revised—“A STA that declares support for HE trigger-based PPDUs shall also declare whether they belong to class A or class B. Class A STAs are high capability devices and class B STAs are low capability devices.” This text is not required as the ‘Class of Device’ capability description is sufficient. Detailed description of Class A and Class B is 28.3.14.Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 3554. |
| 5157 | 9.4.2.218.3 | 86.30 | Regarding "A STA that declares support for HE trigger-based PPDUs", how does a STA declare support? i.e. what field is set? | As in comment | Revised—“A STA that declares support for HE trigger-based PPDUs shall also declare whether they belong to class A or class B. Class A STAs are high capability devices and class B STAs are low capability devices.” This text is not required as the ‘Class of Device’ capability description is sufficient. Detailed description of Class A and Class B is 28.3.14.Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 5157. |
| 5786 | 9.4.2.218.3 | 84.49 | Too many capabilities related Beamformee STS: "Beamformee STS for <=80", "NSTS\_total for <=80MHz", same two capabilities for >80mHz. Almost all exisiting client devices have same numbers for these two capabilities, it is better to merge these two capabilities | Merge to "Beamformee STS for <=80MHz" and "Beamformee STS for >80MHz", each of them represents the single NSTS\_total upper limit that a STA may receive in either an NDP or an DL-MUMIMO PPDU. | Revised—Resolved in 11-17/0056r1 through CID 7684 and 7685. |
| 5789 | 9.4.2.218.3 | 84.12 | Only maximum constellation capability for DCM in SIGB is meaningful, the max NSS capability is only applied for DCM in Data field. | B25:24, and B28:27 are for max constellation support for DCM in both Data and SIGB; B26 and B29 are for max Nss support for DCM in Data field only. | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 5789. |
| 6429 | 9.4.2.218.3 | 86.31 | Vague and unhelpful terminology: "Class A STAs are high capability devices and Class B STAs are low capability devices." Since the terms "high capability" and "low capability" are not defined here, this statement does not provide useful information. At best it conveys a rough intuitive idea of what was intended. This might be appropriate in marketing slides or a tutorial presentation but it should have no place in a specification. | Change to "Class A STAs support the mandatory features described in x.y.z.w" or appropriate equivalent text. | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 6429. |
| 7558 | 9.4.2.218.3 | 83.22 | It is not necessary for a transmitter to announce its transmitting capability of a feature to the receiver. | Change the definition per the comment | Revised—A Beamformer support of 4x LTF + 3.2 us GI for NDP transmission is optional.A Beamformee support of 4x LTF + 3.2 us GI for NDP reception is optional.The Beamformer support is not needed to be advertised. Thus B16 bit can be made reserved.Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 7558. |
| 8258 | 9.4.2.218.3 | 86.30 | Class A STAs are high capability devices and class B STAs are low capability devices. There is missing a link to a detailed definition of such classes. | as per comment | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 8258. |
| 9083 | 9.4.2.218.3 | 83 | Table 9-262 aa has the following line "B15: Indicates support of reception of 1xLTF and 1.6uS guard interval duration for HE Trigger-based PPDUs" - change reception to transmission | Change reception to transmission | Revised— 1x HE-LTF + 1.6 us GI is CM (conditioned upon support of UL MU-MIMO on Full BW).1x HE-LTF use is disallowed with OFDMA (i.e., HE MU PDU and HE TRIG PPDU with more than one RU).Hence this capability is not required.TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 9083. |
| 9114 | 9.4.2.218.3 | 84.6 | Not clear which field(s) (or OFDM symbols) the constellation support and Nss support apply to. | Clarify exactly which of the constellation or spatial stream support constraintsapply to DCM DATA and SIGB DCM. | Revised— Agree in principal. Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 9114. |
| 8676 | 9.4.2.218.3 | 84.49 | Beamformee STS Capability is indicated in the HE Capabilities element. We believe HE should support MU-MIMO and BF optimized for up to 8 antennas. This means not being restricted by limited feedback capability of certain non-AP STAs. Ideally, all non-AP STAs should support Beamformee STS Capability equal to 8. Given that the feedback requirements are relatively straightforward for 1 and 2-antennas receivers, we could consider making it mandatory for those STAs. These are also the devices that are prime candidates for MU-MIMO and BF. | Define a class of non-AP STAs for which Beamformee STS Capability (and NSTS Total Capability) equal to 8 is mandatory (for instance, as function of N\_STS supported by STA) | Revised—Agree with the general direction provided in the comment. However, to support different variations of 11ax devices without burdening implementations, mandating Max Nss per user at 4 is reasonable. At the same time, support of Max Nss > 4 and up to 8 is optionalOn the other hand, it is noticed that Max Nc capability is missing in the D1.0.The max Nc for sounding feedback that a BFee can support shall be negotiated through a capability exchange at association.[PHY Motion 150, March 2016, see 16/389]TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 8676. |
| 8381 | 9.4.2.218.3 | 81.8 | Currently STBC capability if enabled would need to be supported over all BWs. STBC processing for 160MHz channels results in extra Si cost and value of using STBC in 160MHz is low and negligible. There should be a capability bit for Tx/Rx STBC with 160 MHz, so this cost is not needed for every STA supporting STBC. | Change "STBC Tx and Rx" to "STBC Tx and Rx for PPDU with bandwidth smaller than or equal to 80MHz." Add a new field with two bits at the end for "STBC Tx and Rx for PPDU with bandwidth equal to 160 MHz" | Revised—11ax follows 4x numerology. The processing of STBC requires two symbols, which further double the requirement for processing (e.g., for 160 MHz bandwidth, processing of 2 x 2x996 tones). Hence, it is reasonable to separate out the capability of 160 MHz for STBC.TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 8381. |
| 6074 | 9.4.2.218.3 | 86.18 | 1x LTF and 1.6us GI for HE Trigger based PPDU is CM and no need to have B15 | Delete B15 | Revised—1x HE-LTF + 1.6 us GI is CM (conditioned upon support of UL MU-MIMO on Full BW).1x HE-LTF use is disallowed with OFDMA (i.e., HE MU PDU and HE TRIG PPDU with more than one RU).Hence this capability is not required.TGax Editor to make the changes shown in IEEE 802.11-17/0242r5 under all headings that include CID 6074. |

### 9.4.2.218.3 HE PHY Capabilities

**TGax Editor: Please make the following changes to section 9.4.2.218.3 (**Figure 9-589cl—HE PHY Capabilities Information field format)**.**

 B0 B1 B7 B8 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20 B21

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dual Band Support | Channel Width Set | Preamble Puncturing Rx | Device Class | LDPC Coding In Payload | HE-LTF and GI For HE PPDUs | Reserved (#7588,#6074,#9083) | HE-LTF and GI For NDP | STBC Tx & Rx For $\leq 80$ MHz (#8381) | Doppler |

Bits: 1 7 4 1 1 2 2 2 2

B22 B23 B24 B26 B27 B29 B30 B31 B32 B33 B34 B36 B37 B39

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL MU-MIMO | DCM Encoding Tx | DCM Encoding Rx | UL HE MU PPDU Payload Support | SU Beamformer | SU Beamformee | MU Beamformer | Beamformee STS For $\leq $80 MHz | Beamformee STS For > 80 MHz |

Bits: 2 3 3 1 1 1 1 3 3

B40 B42 B43 B45 B46 B47 B48 B49 B50 B52 B53 B54

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of Sounding Dimensions For $\leq 80$ MHz | Number of Sounding Dimensions For $>80$ MHz | Ng = 16 For SU Feedback Support | Ng = 16 For MU Feedback Support | Codebook Size $\left(ϕ,ψ\right)=\{4,2\}$ For SU Support | Codebook Size $\left(ϕ,ψ\right)=\{7,5\}$ For MU Support | Beamforming Feedback With Trigger Frame | Extended Range Support on Partial BW | DL MU-MIMO On Partial Bandwidth |

Bits: 3 3 1 1 1 1 3 1 1

B55 B56 B57 B58 B59 B61 B62 B63 B64 B71 ~~B59 B71~~

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| PPE Threshold Present | SRP-Based SR Support | Power Boost Factor $α\_{r}$ Support | 4x HE-LTF And 0.8 $μ$s GI For HE SU PPDUs | Maximum Nc (#8676) | STBC Tx & Rx For $> $80 MHz(#8381) | Reserved | ~~Reserved~~ |

Bits: 1 1 1 1 3 2 8 ~~13~~

Figure 9-589cl—HE PHY Capabilities Information field format

**TGax Editor: Please make the following changes to section 9.4.2.218.3 (T**able 9-262aa—Subfields of the HE PHY Capabilities Information field).

Table 9-262aa—Subfields of the HE PHY Capabilities Information field

|  |  |  |
| --- | --- | --- |
| Maximum Nc (#8676) | B59-B61: For a transmitting STA acting as a beamformee, it indicates the maximum Nc for beamforming sounding feedback supported. | If SU Beamformee Capable then B59-B61 set to maximum Nc for beamforming sounding feedback minus 1. Otherwise, reserved. |

**TGax Editor: Please make the following changes to section 27.6.2(Rules for HE Sounding protocol sequences**).

An HE beamformer that sets the Feedback Type subfield of a STA Info field to MU shall set the Nc Index field to a value less than or equal to the minimum of:

* The maximum number of supported spatial streams according to the corresponding HE beamformee's Rx HE-MCS Map subfield in the supported HE-MCS and NSS set field
* The maximum number of supported spatial streams according to the Rx NSS subfield value in the operating mode field of the most recently received Operating Mode Notification frame or the Operating Mode Notification element with the Rx NSS Type subfield equal to 0 for the corresponding HE beamformee.
* The maximum number of supported spatial streams according to the Rx NSS subfield value in the most recently received frame that carried a Received Operating Mode Indication subfield (see 27.8 (Operating mode indication)).
* The maximum Nc according to the corresponding HE beamformee’s Maximum Nc subfield (see 9.4.2.218.3 (HE PHY Capabilities)). (#8676)

**TGax Editor: Please make the following changes to section 9.4.2.218.3 on Pg 86, line 30 (CIDs: 3554, 5157, and 8258)**

~~A STA that declares support for HE trigger-based PPDUs shall also declare whether they belong to class A or class B. Class A STAs are high capability devices and class B STAs are low capability devices.~~ (#**3554, #5157, #8258, #6429)**

**TGax Editor: Please make the following changes to section 9.4.2.218.3 (CIDs: 5789, and 9114)**

Table 9-262aa—Subfields of the HE PHY Capabilities Information field

|  |  |  |
| --- | --- | --- |
| DCM Encoding At Tx And Rx | B24:B25: signals maximum constellation support for DCM in both Data and HE-SIG-B fields at TxB26: signals maximum number of spatial streams support for DCM in Data field at Tx.B27:B28: signals maximum constellation support for DCM in both Data and HE-SIG-B fields at RxB29: signals maximum number of spatial streams support for DCM in Data field at Rx. (#5789, #9114) ~~B24 – B26: Signals support of Tx of (i) packet payload with dual sub-carrier modulation at a STA and (ii) DCM encoded HE-SIG-B in an HE MU PPDU at a STA. The signaling includes maximum constellation and the maximum number of spatial streams that are supported with DCM.~~~~B27 – B29: Signals support of reception of (i) packet payload with dual sub-carrier modulation at a STA and (ii) DCM encoded HE-SIG-B in an HE MU PPDU at a STA. The ignalling includes maximum constellation and the maximum number of spatial streams that are supported with DCM.~~ | B25:B24 signals Maximum Constellation.00: Does not support DCM, 01: BPSK , 10: QPSK, 11: 16-QAM. B26 signals maximum number of spatial streams with DCM.0: 1 spatial stream, 1: 2 spatial streams.B28:B27 signals Maximum Constellation.00: Does not support DCM, 01: BPSK , 10: QPSK, 11: 16-QAM. B29 signals maximum number of spatial streams with DCM.0: 1 spatial stream, 1: 2 spatial streams. |

**TGax Editor: Please make the following changes to section 9.4.2.218.3 (CIDs: 7558)**

Table 9-262aa—Subfields of the HE PHY Capabilities Information field

|  |  |  |
| --- | --- | --- |
| Reserved (#7558) | B16: Reserved. (#7558) | Reserved. (#7558) |
| HE-LTF And GI For NDP | ~~B16:~~ ~~For a transmitting STA acting as beamformer, it indicates support of NDP transmission using 4x LTF and 3.2 us guard interval duration.~~ B17: For a transmitting STA acting as beamformee, it indicates support of NDP reception using 4x LTF and 3.2 us guard interval duration. | ~~If the SU Beamformer Capable field is set to 1 then B16 set to 1 if supported by the STA. Set B16 to 0 otherwise.~~~~If SU Beamformer Capable field is set to 0 then~~ B16 is reserved.If the SU Beamformee Capable field is set to 1 then B17 set to 1 if supported by the STA. Set B17 to 0 otherwise.If SU Beamformee Capable field is set to 0 then B17 is reserved. |

**TGax Editor: Please make the following changes to section 9.4.2.218.3 (CIDs: 6074, 9083)**

Table 9-262aa—Subfields of the HE PHY Capabilities Information field

|  |  |  |
| --- | --- | --- |
| HE-LTF And GI For HE PPDUs | B14: Indicates support of reception of 1x LTF and 0.8 us guard interval duration for HE SU PPDUs.~~B15: Indicates support of reception of 1x LTF and 1.6 us guard interval duration for HE Trigger-based PPDUs~~.  | B14 set to 1 if supported by theSTA. B14 set to 0 otherwise. ~~B15 set to 1 if supported by the~~~~STA. B15 set to 0 otherwise.~~ |
| Reserved | B15: Reserved. (#6074, #9083) | Reserved. |

**TGax Editor: Please make the following changes to section 9.4.2.218.3 (CIDs: 8381)**

Table 9-262aa—Subfields of the HE PHY Capabilities Information field

|  |  |  |
| --- | --- | --- |
| STBC Tx And Rx For $\leq $ 80 MHz (#8381) | B18 indicates support for the transmission of HE PPDUs having bandwidth less than or equal to 80 MHz and (#8381) using STBC with one spatial stream. B19 indicates support for the reception of HE PPDUs having bandwidth less than or equal to 80 MHz and (#8381) using STBC with one spatial stream. | B18 set to 1 if supported by the STA. Set to 0 otherwise. B19 set to 1 if supported by the the STA. Set to 0 otherwise. |

**TGax Editor: Please add the following to the end of the Table9-262aa in section 9.4.2.218.3 (CIDs: 8381)**

|  |  |  |
| --- | --- | --- |
| STBC Tx And Rx For $>$ 80 MHz (#8381) | B62 indicates support for the transmission of HE PPDUs having bandwidth greater than 80 MHz and (#8381) using STBC with one spatial stream. B63 indicates support for the reception of HE PPDUs having bandwidth greater than 80 MHz and (#8381) using STBC with one spatial stream. | B62 set to 1 if supported by the STA. Set to 0 otherwise. B63 set to 1 if supported by the the STA. Set to 0 otherwise. |

**References:**

1. **IEEE P802.11axTM/D1.0, Nov 2016.**