IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Comment Resolutions on Clause 28.1.1 (HE PHY Introduction)  Part 4 | | | | |
| Date: 2017-02-09 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Lochan Verma | Qualcomm Inc. | 5775 Morehouse Dr, San Diego, CA 92121 | +1-858-845-7832 | lverma@qti.qualcomm.com |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |  |

Abstract

This submission proposes resolutions for the following 31 comments on Clause 28.1.1 of TGax D1.0:

7036, 7217, 7218, 7428, 7429,

7824, 8359, 8626, 8627, 8629,

8630, 8631, 8632, 8633, 8634,

8636, 8731, 8732, 8735, 8737,

8739, 9113, 9134, 9136, 9777,

7778, 9779, 9780, 10081 10082,

10196

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: 9136 edited

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.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause Number** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 7036 | 28.1.1 | 209.42 | Channel puncturing is not a defined terminology. Please use the term "preamble puncturing" instead. | Change from "supports channel puncturing" to "supports preamble puncturing" | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 7036. |
| 7428 | 28.1.1 | 209.42 | "channel puncturing" should be changed to "preamble puncturing" | as per comment | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 7428. |
| 7429 | 28.1.1 | 209.57 | DCM can also be combined with QPSK. | change "The HE PHY data subcarriers are modulated using binary phase shift keying (BPSK), BPSK dual-carrier modulation (DCM), quadrature phase shift keying (QPSK), 16-quadrature amplitude modulation (16-QAM), 16-QAM DCM, 64-QAM, 256-QAM and 1024-QAM" to "The HE PHY data subcarriers are modulated using binary phase shift keying (BPSK), BPSK dual-carrier modulation (DCM), quadrature phase shift keying (QPSK), QPSK DCM, 16-quadrature amplitude modulation (16-QAM), 16-QAM DCM, 64-QAM, 256-QAM and 1024-QAM" | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 7429. |
| 7824 | 28.1.1 | 211.64 | It says, "... except if the non-AP STA is 20 MHz-only capable", which is not a well-defined term. Per the PICS (and the top of page 210), all HE non-AP STAs are 20 MHz-only "capable" (it is 'M'). I think in this clause it means doing 20 MHz-only operation. (Or, is that called "20 MHz operation", or a "20 MHz operating STA" - see 28.3.3.5?) | Change "20 MHz-only capable" to "a 20 MHz-only STA", at P212L1, and throughout page 212. Clarify (due to the statement at P210L1 that all HE non-AP STAs are inclusive of 20 MHz-only STAs), that the bullets at P212L1, P212L13 and P212L25 when they say "are not applicable/supported" don't mean that all HE non-AP STAs don't apply/suport these. | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 7824. |
| 8359 | 28.1.1 | 210.01 | The statement "A non-AP STA is inclusive of a 20 MHz-only non-AP STA." is redundant. As already stated in 28.1.1, an HE STA is required to comply to clause 19 stated on lines 14-17 or clause 19 stated on lines 18-19. | Remove this line. | Revised—  The statement is deleted.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8359. |
| 8626 | 28.1.1 | 209.36 | run-on sentence | Start new sentence starting at "and in an MU-MIMO resource unit" | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8626. |
| 8627 | 28.1.1 | 209.44 | Change RU to "resource unit" as in the paragraph above. | See comment | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8627. |
| 8629 | 28.1.1 | 209.64 | Clarify sentence | Change "An HE STA refers to an AP STA and a non-AP STA" to "The term HE STA can refer to both an AP STA or a non-AP STA" | Revised—  This sentence is not required here.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8629. |
| 8630 | 28.1.1 | 210.01 | Delete sentence | "A non-AP STA is inclusive of a 20 MHz-only non-AP STA." is not needed. The capabilities listed below make that clear. If anything, the sentence is confusing. | Revised—  Agree in principal with the comment.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8630. |
| 8631 | 28.1.1 | 210.09 | What is "primary 20 MHz PPDU bandwidth"? | Does it mean a single 242-tone RU occupying the primary 20 MHz channel? | Revised—  Yes, intent is to refer to 242-tone RU occupying P20.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8631. |
| 8632 | 28.1.1 | 210.12 | Change "defined" to "allowed". BCC definition is not explicitly linked to bandwidth. | See comment | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8632. |
| 8633 | 28.1.1 | 210.14 | Second bullet should describe the type of PPDU for which BCC is not allowed | Probably something like "an MU PPDU occupying an RU ..." | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8633. |
| 8634 | 28.1.1 | 210.15 | Third bullet should describe the type of PPDU for which BCC is not allowed | Probably something like "an MU PPDU occupying an RU ..." | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8634. |
| 8636 | 28.1.1 | 210.25 | If a STA is 20 MHz-only and were to use more than four streams, then: - BCC is not allowed (per line 16) - LDPC is not mandatory (per lines 23 and 27 ). | How to resolve this? - 20 MHz-only can not send more than 4 streams (or declare capability to do so)? - remove "except when the STA is an 20 MHz only non-AP STA" on lines 25 and 28? | Revised—  If a STA is 20 MHz only and were to use more than 4 streams then LDPC is mandatory.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0243r0 under all headings that include CID 4930. |
| 8731 | 28.1.1 | 210.60 | Support for LDPC coding does not cover the case of 20 MHz-only STA with capability to send more than four streams. Note that for this case, LDPC is neither mandatory or optional. | Clarify requirement | Revised—  If a STA is 20 MHz only and were to use more than 4 streams then LDPC is mandatory.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0243r0 under all headings that include CID 5754. |
| 8732 | 28.1.1 | 211.06 | Improve wording: "the right 106-tone RU" | As opposed to "the wrong 106-tone RU"? Even left/right is not clear when talking about frequency. | Revised—  Replace “right 106-tone RU” with “higher frequency 106-tone RU”  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8732. |
| 8735 | 28.1.1 | 211.33 | Clarify "Reception of the payload of an HE MU PPDU over a 106-tone RU within a 20 MHz PPDU bandwidth and full bandwidth PPDU" | See comment | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0243r0 under all headings that include CID 5747. |
| 8737 | 28.1.1 | 212.09 | What is meant with "partial PPDU bandwidth"? An RU with an MU PPDU? | Clarify | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8737. |
| 8739 | 28.1.3.3 | 213.24 | "HE-PHY-compliant developer" is not clear. | Use wording as in 21.1.3.3 "The models are optimized for simplicity and clarity of presentation, but do not necessarily reflect any particular implementation." | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 8739. |
| 9113 | 28.1.1 | 210.58 | The (4xHELTF+0.8us GI) mode seems to be missing | Include this mode under "may support" | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0243r0 under all headings that include CID 5791. |
| 9134 | 28.1.1 | 209.59 | MCS 1 supports QPSK with DCM | Include QPSK DCM for the supported modulation. | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 9134. |
| 9136 | 28.1.1 | 210.60 | 0.8us + 4x LTF is optional mode to support mainly for beamforming feedback on SU and MU PPDUs | Add the statement to describe 0.8us + 4x LTF optional mode, i.e., "0.8 us GI duration on both HE-LTF and data symbols when the HE-LTF is a 4x-LTF (transmit and receiver) for HE SU PPDUs, HE MU PPDUs" | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r3 under all headings that include CID 9136. |
| 9777 | 28.1.1 | 209.42 | "Channel puncturing" should be "preamble puncturing" | Change "channel puncturing" to "preamble puncturing". Same on P353L55. | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 9777. |
| 9778 | 28.1.1 | 209.44 | "RU" is not defined. | Define the term "RU". | Revised—  Avoiding using acronym.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 9778. |
| 9779 | 28.1.1 | 209.50 | "Symbol duration" has different meaning throughout the draft. P209L51-52 uses it to refer to duration excluding the GI duration. But Table 28-9 and P339L50 use it to refer to duration including the GI duration. 802.11-2016 also uses symbol duration to refer to duration including the GI. Note that Table 28-9 and 11ac uses the term "DFT period" to refer to the duration excluding GI. | Change "symbol durations (symobl duration not including the guard interval" to "DFT periods". Similar changes on P209L52, P302L8 and P302L9. | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 9779. |
| 9780 | 28.1.1 | 209.58 | QPSK DCM is missing. On the other hand, do we need to call out DCM in this list of 'modulations'? DCM does not use a 'separate' modulation/constellation, but simply maps bits to multiple subcarriers using the existing BPSK/QPSK/16-QAM modulations. For example, we don't call out BPSK STBC, QPSK STBC, etc in this list of modulation. | Either remove BPSK DCM and 16-QAM DCM from the list, or add QPSK DCM. | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 9780. |
| 10081 | 28.1.1 | 209.43 | channel puncturing and preamble puncturing are mixed in use through the spec. In order to be consistent, preamble puncturing could be used instead of channel puncturing. | As in the comment. | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 10081. |
| 10082 | 28.1.1 | 209.59 | add QPSK DCM. QPSK modulation with DCM is defined in 28.3.11.9 Constellation mapping | As in the comment. | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 10082. |
| 10196 | 28.1.1 | 209.59 | QPSK DCM is defined in some HE-MCSs tables but not stated here. | Add "QPSK DCM" after "(QPSK)". | Revised—  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-17/0247r2 under all headings that include CID 10196. |

***TGax Editor: Please edit D1.0, Pg 209, ln 36 in section 28.1.1 as follows:***

Both downlink and uplink MU-MIMO transmissions are supported on portions of the PPDU bandwidth (on resource units greater than or equal to 106 tones). ~~and i~~In (#8626) an MU-MIMO resource unit, there is support for up to eight users with up to four space-time streams per user with the total number of space-time streams not exceeding eight.

***TGax Editor: Please edit D1.0, Pg 209, ln 40 in section 28.1.1 as follows. Furthermore, please replace “channel puncturing” with “preamble puncturing” throughout D1.0. (#9777)***

The HE PHY provides support for 20 MHz, 40 MHz, 80 MHz and 160 MHz contiguous channel widths and support for 80+80 MHz non-contiguous channel width, depending on the frequency band and capability. For channel widths greater than or equal to 80 MHz, the HE PHY supports ~~channel~~preamble (#7036, #7428, #9777, #10081) puncturing transmissions where one or more of the non-primary 20 MHz channels in an HE MU PPDU with more than one ~~RU~~resource unit (#8627, #9778) is zeroed out.

The HE PHY data subcarriers are modulated using binary phase shift keying (BPSK), BPSK dual-carrier modulation (DCM), quadrature phase shift keying (QPSK), QPSK DCM, (#7429, #9134, #9780, #10082, #10196) 16-quadrature amplitude modulation (16-QAM), 16-QAM DCM, 64-QAM, 256-QAM and 1024-QAM. Forward error correction (FEC) coding (convolutional or LDPC coding) is used with coding rates of 1/2, 2/3, 3/4 and 5/6.

***TGax Editor: Please edit D1.0, Pg 209, ln 50 in section 28.1.1 as follows:***

The HE PHY provides support for 3.2 μs (1x LTF), 6.4 μs (2x LTF), and 12.8 μs (4x LTF) LTF ~~symbol~~ durations ~~(symbol duration not including the guard interval)~~. The HE PHY supports a single Data field OFDM symbol having duration of 12.8 μs ~~(excluding guard interval)~~. (#9779)

***TGax Editor: Please edit D1.0, Pg 302, ln 08 in section 28.1.1 as follows:***

The duration of each HE-LTF symbol excluding GI is *T*HE-LTF is defined in Equation (28-36). In an HE SU PPDU, HE MU PPDU or HE extended range SU PPDU, the HE-LTF ~~symbol~~ (#9779) duration is indicated in HE-SIG-A field. In an HE trigger-based PPDU, the HE-LTF ~~symbol~~ (#9779) duration is indicated in the Trigger frame that triggers the transmission of the PPDU.

***TGax Editor: Please edit D1.0, Pg 209, ln 64 in section 28.1.1 as follows:***

~~An HE STA refers to an AP STA and a non-AP STA.~~ (#8359, #8629)

***TGax Editor: Please edit D1.0, Pg 210, ln 01 in section 28.1.1 as follows:***

~~A non-AP STA is inclusive of a 20 MHz-only non-AP STA.~~ (#8359, #8630)

***TGax Editor: Please edit D1.0, Pg 210, ln 09 in section 28.1.1 as follows:***

— Transmission and reception of an HE extended range SU PPDU that consists of a ~~single~~ 242-tone (#8631) RU spanning the entire primary 20 MHz PPDU bandwidth

***TGax Editor: Please edit D1.0, Pg 210, ln 10 in section 28.1.1 as follows:***

— Binary convolutional coding (transmit and receive). Note that binary convolutional coding is not ~~defined~~allowed (#8632) for the following:

• An HE SU PPDU with a bandwidth greater than 20 MHz

• An RU of size greater than 242 subcarriers within an HE MU PPDU and an HE trigger-based PPDU (#8633)

• An HE SU PPDU or an RU allocated to a single user within an HE MU PPDU and an HE trigger-based PPDU with (#8634) number of spatial streams greater than 4

• An HE PPDU using HE MCS 10 or 11

***TGax Editor: Please edit D1.0, Pg 211, ln 06 in section 28.1.1 as follows. Furthermore, replace “right 106-tone RU” with “higher frequency 106-tone RU” throughout the D1.0. (#8732)***

— Single spatial stream HE-MCS 0 in the ~~right~~higher frequency (#8732) 106-tone RU of the primary 20 MHz channel for an HE extended range SU PPDU

***TGax Editor: Please edit D1.0, Pg 212, ln 09 in section 28.1.1 as follows***

— Transmission of an HE MU PPDU ~~over partial PPDU bandwidth and full PPDU bandwidth~~ (#8737)

***TGax Editor: Please edit D1.0, Pg 212, ln 01 in section 28.1.1 as follows:***

— 40 MHz and 80 MHz channel widths and all RU sizes and locations applicable to the 40 MHz and 80 MHz channel widths in 5 GHz band (transmit and receive) except ~~if the non-AP STA is~~ for 20 MHz-only non-AP STA ~~capable~~ (#7824) in which case the 40 MHz and 80 MHz channel widths, 996-tone RU, and 484-tone RU sizes in 5 GHz band are not applicable

— A ~~non-AP STA that is~~ 20 MHz-only non-AP STA ~~capable~~ (#7824) shall support 106/52/26-tone RU sizes and locations in 40 MHz and 80 MHz channel width in 5 GHz band (transmit and receive)

***TGax Editor: Please edit D1.0, Pg 212, ln 13 in section 28.1.1 as follows:***

— 40 MHz channel width in the 2.4 GHz band (transmit and receive). If 40 MHz channel width in the 2.4 GHz band is supported then all RU sizes and locations applicable to 40 MHz channel width are supported. ~~If the non-AP STA is~~ If it is a 20 MHz-only non-AP STA ~~capable~~ (#7824) then 40 MHz channel width and 484-tone RU size in 2.4 GHz band are not supported

— 242-, 106-, 52- and 26-tone RU sizes and locations in a 40 MHz channel width in the 2.4 GHz band if ~~the non-AP STA is~~ it is a 20 MHz-only non-AP STA ~~capable~~(#7824)

— 242-tone RU sizes and locations in a 40 MHz and 80 MHz channel widths in 5 GHz band if ~~the non-AP STA is~~ it is a 20 MHz-only non-AP STA ~~capable~~(#7824)

— 242-tone RU sizes and locations in a 160 MHz and 80+80 MHz channel widths in 5 GHz band if ~~the non-AP STA is~~ it is a 20 MHz-only non-AP STA ~~capable~~(#7824)

— 160 MHz and 80+80 MHz channel width and 2×996-tone RU size applicable to the 160 MHz and 80+80 MHz channel width in 5 GHz band (transmit and receive). If ~~the non-AP STA is~~ it is a 20 MHz-only non-AP STA ~~capable~~ (#7824) then 160 MHz and 80+80 MHz channel width, 2×996-, 996- and 484-tone RU sizes in 5 GHz band are not applicable

***TGax Editor: Please edit D1.0, Pg 213, ln 20 in section 28.1.4 as follows:***

The models represented by figures and state diagrams are intended to be illustrations of the functions provided. It is important to distinguish between a model and a real implementation. The models are optimized for simplicity and clarity of presentation. ~~the actual method of implementation is left to the discretion of the HE-PHY-compliant developer.~~ (#8739)

***TGax Editor: Please edit D1.0, Pg 210, in section 28.1.1 as follows to add the following:***

An HE STA may support the following Clause 28 features:

— 0.8 μs GI duration on both HE-LTF and data symbols when the HE-LTF is a 4x (#9136) LTF (transmit and receive) for HE MU PPDUs

***TGax Editor: Please edit D1.0, Table 9-262aa (Subfields of the HE PHY Capabilities Information field):***

|  |  |  |
| --- | --- | --- |
| 4x HE-LTF And 0.8 us GI Support For HE PPDUs | 4x HE-LTF And 0.8 us GI Support For HE PPDUs Indicates support for the reception of 4x LTF and 0.8 us guard interval duration for HE SU PPDUs and HE MU PPDUs. (#9136) | Set to 1 if supported. Set to 0 otherwise. |

**References:**

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