IEEE P802.11
Wireless LANs

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| Text modification on HE-SIG-B part 2 |
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| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Yujin Noh | Newracom | 9008 Research Dr.Irvine, CA 92618 |  | yujin.noh at newracom.com |
| Sigurd Schelstraete | Quantenna Communications | 3450 W. Warren AveFremont, CA 94538  | +1 510 743 2288 | Sigurd at quantenna.com |
| Dongguk Lim | LG Electronics | 19, Yangjae-daero 11gil, Seocho-gu, Seoul 137-130, Korea  |  | dongguk.lim at lge.com  |
| Sungeun Lee | Cypress Semiconductor Corporation | Hazlet, NJ, 07730 |  | sungeun.lee at cypress.com |
| Ming Gan | Huawei | F1-17, Huawei Base, Bantian, Shenzhen |  | ming.gan at huawei.com |

Abstract

The submission provides text proposal related to HE-SIG-B field.

* CID10060 was approved with the resolution that applied to only 28.3.10.8.1 to 28.3.10.8.3. (3 sub-clauses)
* The same resolution is applied to 28.3.10.8.4 to 28.3.10.8.5. (2 sub-clauses)
* Text proposal based on 11ax D1.3.

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.***

**Discussion**

* The modifications improve the wording and description
* HE-SIG-B section mixes terminology in the description between “Common Block field” vs “Comon field” and “User Specific field” vs “User Block field” vs “User field”.
	+ Common Block field should be replaced with Common field to keep consistency.
	+ User field should be used when describing individual user content (see 28.3.10.8.5 HE-SIG-B per-user content).
	+ User Block field should be used when describing the field which made up of two User fields (or one User field depending on the number of assigned users), CRC bits and tail bits (see Figure 28-20).
	+ User Specific field consisting of the User fields and padding bits (if present) should be used when describing on the whole content.
* RU Allocation field and RU Allocation subfield are mixed in use. RU Allocation field consists of N RU Allocation subfields where N is determined based on the PPDU bandwidth.
* “Padding bits are not added after the Common field” is not correct because if no user is assigned in HE-SIG-B content channel, padding bits are added after the Common field. The corresponding text is modified.
* Propose to clean up the text and use the consistent terminology.
* The meaning of 8 bits indices of 01110010 and 01110011 in Table 28-23 (RU allocation signaling: arrangement and number of MU-MIMO allocations) is ambiguous which HE-SIG-B content channel is the corresponding HE-SIG-B content channel. 
	+ To make it clear, the location of the corresponding 8-bit RU Allocation subfield is added. For example, “484-tone RU with zero User field in the HE-SIG B content channel that contains the corresponding 8-bit RU Allocation subfield.”



* The description of y2y1y0 in Table 28-23 (RU allocation signaling: arrangement and number of MU-MIMO allocations) needs to be modified to consider the load balancing for RUs of size greater than 242 subcarriers. In this case, the total number of users assigned for this RU is obtained as the sum of the number of User fields indicated by the 8-bit RU Allocation subfield in each HE-SIG-B content channel.
	+ In the case of load balancing for RUs of size greater than 242-tone RU, y2y1y0 = 000–111 indicates number of User fields in the HE-SIG-B content channel that contains the corresponding 8-bit RU Allocation subfield. Otherwise, y2y1y0 = 000–111 indicates number of STAs multiplexed in the 106-, 242-tone RU or the lower frequency 106-tone RU if there are two 106-tone RUs and one 26-tone RU is assigned between two 106-tone RUs.

**Changes to Section 28.3.10.8.2, 28.3.10.8.3, 28.3.10.8.4 and 28.3.10.8.5**

***To TGax editor:*** ***P374L48*** *replace the current text with the proposed changes below.*

***------------- Begin Text Changes ---------------***

The Common field(#10060) of HE-SIG-B content channel 1 contains the following: an RU Allocation subfield(#10061) for RUs with subcarrier indices in the range [-500:-259], followed by a second RU Allocation subfield(#10061) for RUs with subcarrier indices between [17:258] and 1 bit to indicate the presence of the User field corresponding to the center 26-tone RU that spans subcarriers [-16:-4, 4:16]. The second HE-SIG-B content channel(#10060) carries a Common field(#10060) and User Specific field corresponding to RUs whose subcarrier indices fall in those segments. The Common field(#10060) of HE-SIG-B content channel 2 contains the following: an RU Allocation subfield(#10061) for RUs whose subcarrier indices fall in the range [-258:-17], followed by a second RU Allocation subfield(#10061) for RUs with sub-carrier indices between [259:500] and 1 bit to indicate presence of the User field corresponding to the center 26-tone RU that spans subcarriers [-16:-4, 4:16]. The same value for the bit signaling presence of the center 26-tone RU is carried in both HE-SIG-B content channels(#10060).

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| * Mapping of the two HE-SIG-B content channels and their duplication in an 80 MHz PPDU when the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 0(#5272)
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***------------- End Text Changes ---------------***

***To TGax editor:*** ***P373L37*** *replace the current text with the proposed changes below.*

***------------- Begin Text Changes ---------------***

The User Specific field of an HE-SIG-B content channel consists of one or more User Block fields and/or Padding.

***------------- End Text Changes ---------------***

***To TGax editor:*** ***P376L50*** *replace the current text with the proposed changes below.*

***------------- Begin Text Changes ---------------***

In each 20 MHz band, the bits in the Common field(#10060) shall have CRC and tail bits added and then be BCC encoded at rate R = ½. The CRC bits are computed as described in 28.3.10.7.3 (CRC computation). No padding bits are added between the Common field and the User Specific field.

***------------- End Text Changes ---------------***

***To TGax editor:*** ***P378L16*** *replace the current text with the proposed changes below.*

***------------- Begin Text Changes ---------------***

The Common field in the HE-SIG-B carries the RU Allocation subfields. Depending on the PPDU bandwidth, the Common field can contain multiple RU Allocation subfields. The format of the Common field is defined in Common field .

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| * Common field
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| Field | Number of bits | Description |
| RU Allocation | *N* x 8 | Indicates the RU assignment in the frequency domain. It also indicates the number of users (#8951)in each RU. For RUs of size greater than or equal to 106-tones that support MU-MIMO, it indicates the number of users multiplexed using MU-MIMO.Consists of N RU Allocation subfields: *N*= 1 for a 20 MHz and a 40 MHz HE MU PPDU*N*= 2 for an 80 MHz HE MU PPDU*N* = 4 for a 160 MHz or 80+80 MHz HE MU PPDU |
| Center 26-tone RU | 1 | This field is present only when the value of the Bandwidth field of HE-SIG-A field in an HE MU PPDU is set to greater than 1.(#4890, #4922)When the Bandwidth field of the HE-SIG-A field in an HE MU PPDU is set to 2, 4 or 5 for 80  MHz:Set to 1 to indicate that a user is allocated to the center 26-tone RU (see **Error! Reference source not found.**); otherwise, set to 0. Use the same value in both HE-SIG-B content channels. (#8952, #4923)When the Bandwidth field of the HE-SIG-A field in an HE MU PPDU is set to 3, 6 or 7 for 160 MHz or 80+80 MHz:For HE-SIG-B content channel 1, set to 1 to indicate that a user is allocated to the center 26-tone RU of the lower frequency 80 MHz; otherwise, set to 0. For HE-SIG-B content channel 2, set to 1 to indicate that a user is allocated to the center 26-tone RU of the higher frequency 80 MHz; otherwise, set to 0.(#8953, #4924) |
| CRC | 4 | See **Error! Reference source not found.** |
| Tail | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0 |
| NOTE—Integer fields are transmitted in unsigned binary format, LSB first, where the LSB is in the lowest numbered bit position. |

An RU Allocation subfield in the Common field of HE-SIG-B consists of 8 bits that indicates the following for a 20 MHz PPDU BW:

* The RU assignment in the frequency domain: indexes the size of the RUs and their placement in the frequency domain.
* The number of User fields in a 20 MHz BW within the HE-SIG-B content channel: the number of users multiplexed in the RUs indicated by the arrangement; for RUs of size greater than or equal to 106 tones that support MU-MIMO, it indicates the number of users multiplexed using MU-MIMO.

The mapping of the 8-bit RU Allocation subfield to the RU assignment and the number of users(#8954) per RU is defined in the RU allocation signaling: arrangement and number of MU-MIMO allocations .

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| * 8-bit RU Allocation subfield signaling
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| 8 bits indices(B7 B6 B5 B4 B3 B2 B1 B0) | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | Number of entries |
| 00000000 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| 00000001 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 52 | 1 |
| 00000010 | 26 | 26 | 26 | 26 | 26 | 52 | 26 | 26 | 1 |
| 00000011 | 26 | 26 | 26 | 26 | 26 | 52 | 52 | 1 |
| 00000100 | 26 | 26 | 52 | 26 | 26 | 26 | 26 | 26 | 1 |
| 00000101 | 26 | 26 | 52 | 26 | 26 | 26 | 52 | 1 |
| 00000110 | 26 | 26 | 52 | 26 | 52 | 26 | 26 | 1 |
| 00000111 | 26 | 26 | 52 | 26 | 52 | 52 | 1 |
| 00001000 | 52 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| 00001001 | 52 | 26 | 26 | 26 | 26 | 26 | 52 | 1 |
| 00001010 | 52 | 26 | 26 | 26 | 52 | 26 | 26 | 1 |
| 00001011 | 52 | 26 | 26 | 26 | 52 | 52 | 1 |
| 00001100 | 52 | 52 | 26 | 26 | 26 | 26 | 26 | 1 |
| 00001101 | 52 | 52 | 26 | 26 | 26 | 52 | 1 |
| 00001110 | 52 | 52 | 26 | 52 | 26 | 26 | 1 |
| 00001111 | 52 | 52 | 26 | 52 | 52 | 1 |
| 00010y2y1y0 | 52 | 52 | - | 106 | 8 |
| 00011y2y1y0 | 106 | - | 52 | 52 | 8 |
| 00100y2y1y0 | 26 | 26 | 26 | 26 | 26 | 106 | 8 |
| 00101y2y1y0 | 26 | 26 | 52 | 26 | 106 | 8 |
| 00110y2y1y0 | 52 | 26 | 26 | 26 | 106 | 8 |
| 00111y2y1y0 | 52 | 52 | 26 | 106 | 8 |
| 01000y2y1y0 | 106 | 26 | 26 | 26 | 26 | 26 | 8 |
| 01001y2y1y0 | 106 | 26 | 26 | 26 | 52 | 8 |
| 01010y2y1y0 | 106 | 26 | 52 | 26 | 26 | 8 |
| 01011y2y1y0 | 106 | 26 | 52 | 52 | 8 |
| 0110y1y0z1z0 | 106 | - | 106 | 16 |
| 01110000 | 52 | 52 | - | 52 | 52 | 1 |
| 01110001 | 242-tone RU empty | 1 |
| 01110010 | 484-tone RU with zero User field in the HE-SIG-B Content Channel containing this 8-bit RU Allocation subfield | 1 |
| 01110011 | 996-tone RU with zero User field in the HE-SIG-B Content Channel containing this 8-bit RU Allocation subfield | 1 |
| 011101x1x0 | Reserved | 4 |
| 01111y2y1y0(#9554) | Reserved | 8 |
| 10y2y1y0z2z1z0 | 106 | 26 | 106 | 64 |
| 11000y2y1y0 | 242 | 8 |
| 11001y2y1y0 | 484 | 8 |
| 11010y2y1y0 | 996 | 8 |
| 11011y2y1y0 | 2996 | 8 |
| 111x4x3x2x1x0 | Reserved | 32 |
| In the case of load balancing for RUs of size greater than 242-tone RU, y2y1y0 = 000–111 indicates number of User fields in the HE-SIG-B content channel that contains the corresponding 8-bit RU Allocation subfield. Otherwise, y2y1y0 = 000–111 indicates number of STAs multiplexed in the 106-, 242-tone RU or the lower frequency 106-tone RU if there are two 106-tone RUs and one 26-tone RU is assigned between two 106-tone RUs. The binary vector y2y1y0 indicates 22 × y2 + 21 × y1 + y0 + 1 STAs multiplexed the RU.(#4891, #6118, #8155, #10066, #10217)z2z1z0 = 000-111 indicates number of STAs multiplexed in the higher frequency 106-tone RU if there are two 106-tone RUs and one 26-tone RU is assigned between two 106-tone RUs. The binary vector z2z1z0 indicates 22 × z2 + 21 × z1 + z0 + 1 STAs multiplexed in the RU.(#4891)Similarly, y1y0 = 00-11 indicates number of STAs multiplexed in the lower frequency 106-tone RU. The binary vector y1y0 indicates 21 × y1 + y0 + 1 STAs multiplexed in the RU.(#4891)Similarly, z1z0 = 00-11 indicates the number of STAs multiplexed in the higher frequency 106-tone RU. The binary vector z1z0 indicates 21 × z1 + z0 + 1 STAs multiplexed in the RU.(#4891)#1 to #9 (from left to the right) is ordered in increasing order of the absolute frequency.x1x0 = 00-11, x4x3x2x1x0 = 00000–11111.‘-’ means no STA in that RU. |

 In the table, the Number of entries column refers to the number of 8 bits indices that refer to the same RU assignment in the frequency domain but differ in the number of User fields per RU. The RU assignment and the number of User fields per RU together indicate the number of User fields in the User Specific field of HE-SIG-B. Signaling for the center 26-tone RU in BW80 MHz follows the RU Allocation fields. When the Bandwidth field of the HE-SIG-A field in an HE MU PPDU is set to 2, 4 or 5 for 80 MHz, 1 bit is added to indicate if a user is allocated to the center 26-tone RU. The bit has the same value for both HE-SIG-B content channels. When the Bandwidth field of HE-SIG-A field in an HE MU PPDU is set to 3, 6 or 7 for 160 MHz or 80+80 MHz, 1 bit in HE-SIG-B content channel 1 indicates whether a user is allocated to the center 26-tone RU of lower frequency 80 MHz, and 1 bit in HE-SIG-B content channel 2 indicates if a user is allocated to the center 26-tone RU of higher frequency 80 MHz.(#4890)

The number of RU Allocation subfields in the Common field depends on the PPDU bandwidth

* (#5272)When the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 0, for a 20 MHz and a 40 MHz PPDU, each HE-SIG-B content channel contains one RU Allocation subfield in the Common field followed by multiple User fields. The position of the User field in the User Specific field together with the 8-bit RU Allocation subfield indicates the RU assignment to each user.(#8958)
* When the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 0 (#5272)for an 80 MHz PPDU, each HE-SIG-B content channel contains two RU Allocation subfields for a total of 16 bits of RU allocation signaling, one each for the RUs in the two 20 MHz segments of the HE-SIG-B content channel. The position of the User field in the User Specific field together with the 8-bit RU Allocation subfield indicates the RU assignment to each(#8959) user. The User fields corresponding to the first RU Allocation subfield are followed by the User fields indicated by the second RU Allocation subfield in the User Specific field.
* When the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 0 (#5272)for a 160 MHz PPDU, each HE-SIG-B content channel contains four RU Allocation subfields for a total of 32 bits of RU allocation signaling, one each for the RUs in the four 20 MHz segments of the HE-SIG-B content channel. The position of the User field in the User Specific field together with the 8-bit RU Allocation subfield indicates the RU assignment to each(#8960) user. The User fields for each of the 20 MHz segments in the content channel are arranged by the order in which their RU Allocation subfields appear in the Common field.
* HE-SIG-B per-user content

The User Specific field consists of multiple User fields. The User fields follow the Common field of HE-SIG-B. The RU Allocation field in the Common field and the position of the User field in the User Specific field together identify the RU used to transmit a STA’s data. Multiple RUs addressed to a single STA shall not be allowed in the User Specific field(#5273). Therefore, the signaling that enables STAs to decode its data is carried in only one User field. An example for the mapping of the 8-bit RU Allocation subfield and the position of the User field to an STA’s data is illustrated in Illustration for the mapping of the 8-bit RU Allocation subfield and the positi. The RU Allocation subfield indicates an arrangement of 106-tone RU followed by five 26-tone RUs and that the 106-tone RU contains three User fields, i.e., the 106-tone RU supports multiplexing of three users using MU-MIMO. The eight User fields in the User Specfic field thus map to the 6 RUs, with the first three User fields indicating MU-MIMO allocations in the first 106-tone RU followed by User fields corresponding to the each of the five 26-tone RUs.

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| * Illustration for the mapping of the 8-bit RU Allocation subfield and the position of the User field to the STA's assignment
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The contents of the User field differ depending on whether the field addresses a STA in a non-MU-MIMO allocation in an RU or a STA in an MU-MIMO allocation in an RU(#8961, #8963). Irrespective of whether the allocation is for a STA in a non-MU-MIMO or an MU-MIMO allocation, the size of the User field is the same.

The User field for a non-MU-MIMO allocation contains the fields shown in Table 28-24 - Fields of the User field for a non-MU-MIMO allocation.

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| * Fields of the User field for a non-MU-MIMO allocation
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The User field for a STA in an MU-MIMO allocation contains the fields shown in Table 28-25 - Fields of the User field for an MU-MIMO allocation .

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| * Fields of the User field for an MU-MIMO allocation
 |
| Bit | Field | Number of bits | Description |
|  |  |  |  |
| B11–B14 | Spatial Configuration | 4 | Indication for the number of spatial streams for a STA in an MU-MIMO allocation. See Spatial Configuration field encoding . |
|  |  |  |  |

A User field for an MU-MIMO allocation includes a Spatial Configuration field consisting of 4 bits that indicates the number of spatial streams for each STA and the total number of spatial streams in the MU-MIMO allocation. The subfield shown in Spatial Configuration field encoding  is constructed by using the entries corresponding to the value of number of users (*Nuser*) multiplexed using MU-MIMO in an RU. When MU-MIMO is used in an RU of size less than or equal to 242 subcarriers, the number of users (*Nuser*) in an MU-MIMO allocation is equal to the number of User fields per RU signaled for the RU in the RU Allocation subfield of an Common field in HE-SIG-B. When MU-MIMO is used in RUs of size greater than 242 subcarriers, the number of users (*Nuser*) in an MU-MIMO allocation is computed as the sum of the number of User fields per RU indicated for the RU by the 8-bit RU Allocation subfield in each HE-SIG-B content channel. For a given value of *Nuser*, the four bits of the Spatial Configuration field are used as follows: A STA with a STA-ID that matches the 11-bit ID signaled in the User field for an MU-MIMO allocation derives the number of spatial streams allocated to it using the row corresponding to the signaled 4-bit Spatial Configuration field and the column corresponding to the position of the User field in the User Specific field. The starting stream index for the STA is computed by summing the Nsts in the columns prior to the column indicated by the STA’s User field position. In the case of load balancing for RUs of size greater than 242 subcarriers where User fields corresponding to the same MU-MIMO allocations are split into two HE-SIG-B content channels, the User field positions are logically continuous with the first User field corresponding to the same RU in the second HE-SIG-B content channel updating its position (and therefore, column index) from that of the last User field in the first HE-SIG-B content channel.

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| * Spatial Configuration field encoding
 |
| *Nuser* | B3...B0 | Nsts[1] | Nsts[2] | Nsts[3] | Nsts[4] | Nsts[5] | Nsts[6] | Nsts[7] | Nsts[8] | Total Nsts | Number of entries |
| 2 | 0000–0011 | 1–4 | 1 |  |  |  |  |  |  | 2–5 | 10 |
| 0100–0110 | 2–4 | 2 |  |  |  |  |  |  | 4–6 |
| 0111–1000 | 3–4 | 3 |  |  |  |  |  |  | 6–7 |
| 1001 | 4 | 4 |  |  |  |  |  |  | 8 |
| 3 | 0000–0011 | 1–4 | 1 | 1 |  |  |  |  |  | 3–6 | 13 |
| 0100–0110 | 2–4 | 2 | 1 |  |  |  |  |  | 5–7 |
| 0111–1000 | 3–4 | 3 | 1 |  |  |  |  |  | 7–8 |
| 1001–1011 | 2–4 | 2 | 2 |  |  |  |  |  | 6–8 |
| 1100 | 3 | 3 | 2 |  |  |  |  |  | 8 |
| 4 | 0000–0011 | 1–4 | 1 | 1 | 1 |  |  |  |  | 4–7 | 11 |
| 0100–0110 | 2–4 | 2 | 1 | 1 |  |  |  |  | 6–8 |
| 0111 | 3 | 3 | 1 | 1 |  |  |  |  | 8 |
| 1000–1001 | 2–3 | 2 | 2 | 1 |  |  |  |  | 7–8 |
| 1010 | 2 | 2 | 2 | 2 |  |  |  |  | 8 |
| 5 | 0000–0011 | 1–4 | 1 | 1 | 1 | 1 |  |  |  | 5–8 | 6 |
| 0100–0101 | 2–3 | 2 | 1 | 1 | 1 |  |  |  | 7–8 |
| 6 | 0000–0010 | 1–3 | 1 | 1 | 1 | 1 | 1 |  |  | 6–8 | 4 |
| 0011 | 2 | 2 | 1 | 1 | 1 | 1 |  |  | 8 |
| 7 | 0000–0001 | 1–2 | 1 | 1 | 1 | 1 | 1 | 1 |  | 7–8 | 2 |
| 8 | 0000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | 1 |

When the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 1 (indicating full bandwidth MU-MIMO transmission), the number of STAs in the MU-MIMO group is indicated in the SIGB Number of Symbols/Number of MU-MIMO Users field in the HE-SIG-A field. When the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 1, for bandwidths larger than 20 MHz, the User fields are split equitably between two HE-SIG-B content channels, i.e., for a *k* user MU-MIMO PPDU,  User fields are carried in HE-SIG-B content channel 1 and  User fields in HE-SIG-B content channel 2.

The total number of spatial streams (total *NSTS*) is computed by summing all columns for the row signaled by the Spatial Configuration field and is indicated in Spatial Configuration field encoding  under the column Total Nsts.

***------------- End Text Changes ---------------***