IEEE P802.11  
Wireless LANs

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| PDT-EHT-preamble-EHT-SIG Follow-up | | | | |
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Abstract

This document contains proposed draft text for EHT-preamble-EHT-SIG.

R0: initial version

R1: further reflect Alice, Youhan, Sigurd’s comments.

R2: further reflect Ron and Alice’s comment

R3: further reflect Xiaogang’s comment on Common field

R4: further reflect Xiaogang’s comment on User field

R5: further reflect Dongguk’s editorial change

* EHT-SIG
* General

The EHT-SIG field provides the necessary signaling in addition to U-SIG for the STAs to interpret the EHT PPDU. In EHT-MU PPDU, EHT-SIG contains U-SIG overflow bits that are common to all EHT-SIG content channels and all users. EHT-SIG further contains resource allocation information to allow the STAs to look up the corresponding resources to be used in the EHT modulated fields of the PPDU. The integer fields of the EHT-SIG field are transmitted in unsigned binary format, LSB first, where the LSB is in the lowest numbered bit position.

For OFDMA transmission (in U-SIG, the UL/DL field is set to 0, and the PPDU Type and EHT-SIG Compression Mode field is set to 0), dynamic split is defined as the split of User fields across EHT-SIG content channels according to the Common field in each EHT-SIG content channel.

For non-OFDMA transmission to multiple users (in U-SIG, the UL/DL field is set to 0, and the PPDU Type and EHT-SIG Compression Mode field is set to 2), equitable split is defined as the split of User fields across EHT-SIG content channels.

For non-OFDMA transmission to a single user (in U-SIG, the UL/DL field is set either to 0 or 1, and the PPDU Type and EHT-SIG Compression Mode field is set to 1), the only User field is repeated across EHT-SIG content channels

* ~~For non-OFDMA transmission to a single user (in U-SIG, the UL/DL field is set either to 0 or 1, and the PPDU Type and EHT-SIG Compression Mode field is set to 1), the only User field is repeated across EHT-SIG content channels~~.EHT-SIG content channels

The EHT-SIG field of a 20 MHz EHT MU PPDU contains one EHT-SIG content channel. The EHT-SIG field of an EHT MU PPDU that is 40 MHz or wider contains two EHT-SIG content channels. The EHT-SIG content channels per 80 MHz are allowed to carry different information when EHT MU PPDU is wider than 80 MHz and for OFDMA transmission and for non-OFDMA transmission to multiple users. The EHT-SIG field of an EHT MU-PPDU sent to a single user and the EHT-SIG field of an EHT sounding NDP contain one EHT-SIG content channel and it is duplicated per 20MHz when the EHT PPDU is equal to or wider than 40MHz.

A STA only needs to process up to one 80 MHz segment of the pre-EHT preamble (up-to and including EHT-SIG) to get all the assignment information for itself. No 80 MHz segment change is needed while processing L-SIG, U-SIG and EHT-SIG.

The EHT-SIG content channel format is shown in Figure 36-35 (EHT-SIG content channel format for OFDMA transmission if BW is 20/40/80MHz), Fiure 36-36 (EHT-SIG content channel format for OFDMA transmission if BW is 160MHz), and Figure 36-37 (EHT-SIG content channel format for OFDMA transmission if BW is 320MHz). For an EHT MU PPDU except for EHT sounding NDP, the EHT-SIG content channel consists of a Common field followed by a User Specific field. ~~For an EHT MU PPDU sent to a single user~~, ~~it is TBD~~. For an EHT sounding NDP, the User specific field is not present and the EHT-SIG content channel consists of only a common field. ~~The configuration of the~~~~Common field regarding the position and number of CRC and Tail subfields is TBD for an EHT MU PPDU sent to multiple users. For an EHT MU PPDU sent to a single user, it is TBD. For an EHT NDP, it is TBD~~.



Figure 36-35 (EHT-SIG content channel format for OFDMA transmission if BW is 20/40/80MHz)



Figure 36-36 (EHT-SIG content channel format for OFDMA transmission if BW is 160MHz)



Figure 36-37 (EHT-SIG content channel format for OFDMA transmission if BW is 320MHz)

* ~~Per the authors of 20/1276r7, Figure 36-35 (EHT-SIG content channel format (TBD))is TBD.~~

For OFDMA transmission, the Common field of an EHT-SIG content channel contains information regarding the resource unit allocation such as the RU assignment to be used in the EHT modulated fields of the PPDU, the RUs allocated for MU-MIMO and the number of users in MU-MIMO allocations. In OFDMA transmission, the Common field of EHT-SIG content channel consists of one encoding block when EHT MU PPDU is 20/40/80 MHz PPDU and it consists of two encoding blocks when EHT-MU PPDU is 160/320 MHz PPDU. The first encoding block contains the U-SIG overflow information and two RU allocation subfields and the second encoding block includes all remaining 2 RU allocation subfields and 6 RU allocation subfields for 160MHz and 320MHz, respectively. Each encoding block of the Common field contains the CRC and Tail, separately. The Common field for OFDMA transmission is defined in 36.3.11.8.3 (Comment field for OFDMA transmission). ~~The configuration of the~~~~Common field regarding the position and number of CRC and~~~~Tail subfields is TBD for an EHT MU PPDU sent to multiple users. For an EHT PPDU sent to a single user, it is TBD. For the compressed mode, it is TBD. For an EHT NDP, it is TBD~~. In non-OFDMA transmission, the Common field of an EHT-SIG content channel does not contain the RU allocation subfield. For non-OFDMA transmission except for EHT sounding NDP, the Common field of the EHT-SIG content channel is encoded together with the first user field and this encoding block contains of CRC and Tail. For EHT sounding NDP, the Common field of the EHT-SIG content channel consists of U-SIG overflow information, CRC, and Tail. The Common field for non-OFDMA transmission is defined in 36.3.11.8.4 (Common field for non-OFDMA transmission).

Figure 36-38 EHT-SIG content channel format for non-OFDMA transmission to a single user



Figure 36-39 EHT-SIG content channel format for EHT sounding NDP



Figure 36-40 EHT-SIG content channel format for non-OFDMA transmission to multiple users

The union of the User Specific fields in the EHT-SIG content channels contains information for all users in the PPDU on how to decode their payload. As shown in Figure 36-35 (OFDMA transmission if BW is 20/40/80 MHz ~~(TBD)~~), Fiure 36-36 (EHT-SIG content channel format for OFDMA transmission if BW is 160MHz), and Figure 36-37 (EHT-SIG content channel format for OFDMA transmission if BW is 320MHz), the User Specific field is organized into User Block fields that in turn contain User fields in OFDMA transmission. And, as shown in Figure 36-38 (EHT-SIG content channel format for non-OFDMA transmission to a single user), Figure 36-40 EHT-SIG content channel format for non-OFDMA transmission to multipler users, in the non-OFDMA transmission except for EHT sounding NDP, the User Specific field is organized into User block fields that in turn contain User fields excepted for the first User field. ~~See 36.3.11.8.5 (User Specific field) for a description of the contents of the User Specific field.~~ The contents of the User Specific field is described in 36.3.11.8.5 (User Specific field). ~~It is TBD for an EHT MU PPDU sent to a single user. For the compressed mode, it is TBD. For an EHT NDP, it is TBD.~~

* Common field for OFDMA transmission

The Common field for OFDMA transmission is defined in Table 36-21 (Common field for OFDMA transmission).

***Instruction to the editor:***

***Please replace the original Table 36-23—Common field for noncompressed mode in P802.11be D0.2 with the following table:***

* Common field for OFDMA transmisison

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Bit | Subfield | Number of subfield | Number of bits per subfield | Description |
| B0-B3 | Spatial reuse | 1 | 4 | Indicates spatial reuse paramters during the transmission of this PPDU. |
| B4-B5 | GI+LTF size | 1 | 2 | Indicates the GI duration and EHT-LTF size:  set to 0 to indicate 2x LTF + 0.8us GI ;  set to 1 to indicate 2x LTF + 1.6us GI;  set to 2 to indicate 4x LTF + 0.8us GI;  set to 3 to indicate 4x LTF + 3.2us GI |
| B6-B8 | Number of EHT-LTF symbols | 1 | 3 | Indicates the number of EHT-LTF symbols:  set to 0 to indicate 1 EHT-LTF symbol;  set to 1 to indicate 2 EHT-LTF symbols;  set to 2 to indicate 4 EHT-LTF symbols;  set to 3 to indicate 6 EHT-LTF symbols;  set to 4 to indicate 8 EHT-LTF symbols;  other values are Validated. |
| B9 | LDPC extra symbol segment | 1 | 1 | Indicates the presence of the LDPC extra symbol segment:  Set to 1 if an LDPC extra symbol segment is present  Set to 0 if an LDPC extra symbol segment is not present |
| B10-B11 | Pre-FEC padding factor | 1 | 2 | Indicates the pre-FEC padding factor.  Set to 0 to indicate a pre-FEC padding factor of 4  Set to 1 to indicate a pre-FEC padding factor of 1  Set to 2 to indicate a pre-FEC padding factor of 2  Set to 3 to indicate a pre-FEC padding factor of 3 |
|  |  |  |  |  |
| B12 | PE Disambiguity | 1 | 1 | Indicates PE disambiguity as defined in 36.3.13 (Packet extension). |
| B13-B16 | Disregard | 1 | 4 | Disregard and set to 1 |
| B17 - B 16+9N | RU Allocation-1 | N | 9 | N RU Allocation-1 subfields are present in an EHT-SIG content channel, where:  N=1 if the Bandwidth field in the U-SIG field is 0 or 1 (indicating a 20 MHz or 40MHz EHT MU PPDU)  N=2 if the Bandwidth field in the U-SIG field is 2, 3, 4, or 5 (indicating an 80 MHz, 160MHz, 320MHz-1, or 320MHz-2 EHT MU PPDU)  Each RU Allocation subfield in an EHT-SIG content channel corresponding to a 20MHz frequency segment indicates the RU assignment, including the size of the RU(s) and their placement in the frequency domain, to be used in the EHT modulated fields of the EHT MU PPDU in the frequency domain. It also indicates information needed to compute the number of users allocated to each RU, where the subcarrier indices of the RU(s) meet the conditions in Table 36-22 (RUs associated with each RU Allocation subfield for each EHT-SIG content channel and PPDU bandwidth). |
| B17+9N - B20+9N | CRC-1 | 1 | 4 | The CRC-1 is calculated over bits 0 to 16+9N. |
| B21+9N - B26+9N | Tail-1 | 1 | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0. |
| B27+9N - B26+9N+9M | RU Allocation-2 | M | 9 | M RU Allocation-2 subfields are present in an EHT-SIG content channel, where:  M=0 if the Bandwidth field in the U-SIG field is 0, 1, or 2 (indicating a 20MHz, 40MHz, or 80MHz EHT MU PPDU)  M=2 if the Bandwidth field in the U-SIG field is 3 (indicating a 160MHz EHT MU PPDU)  M=6 if the Bandwidth field in the U-SIG field is 4 or 5 (indicating a 320MHz-1 or 320MHz-2 EHT MU PPDU)  Each RU Allocation subfield in an EHT-SIG content channel corresponding to a 20MHz frequency segment indicates the RU assignment, including the size of the RU(s) and their placement in the frequency domain, to be used in the EHT modulated fields of the EHT MU PPDU in the frequency domain. It also indicates information needed to compute the number of users allocated to each RU, where the subcarrier indices of the RU(s) meet the conditions in Table 36-22 (RUs associated with each RU Allocation subfield for each EHT-SIG content channel and PPDU bandwidth). |
| B27+9N+9M - B30+9N+9M | CRC-2 | 0 or 1 | 4 | The CRC-2 subfield is present if the Bandwidth field in the U-SIG field indicates indicating a 160MHz, 320MHz-1, or 320MHz-2 EHT MU PPDU and not present otherwise.  The CRC-2 is calculated over bits 27+9N to 26+9N+9M. |
| B31+9N+9M - B36+9N+9M | Tail-2 | 0 or 1 | 6 | The Tail-2 subfield is present if the Bandwidth field in the U-SIG field indicates indicating a 160MHz, 320MHz-1, or 320MHz-2 EHT MU PPDU and not present otherwise.  Used to terminate the trellis of the convolutional decoder. Set to 0. |

A 4 tone RU cannot be indicated by the RU allocation subfield.

A 3 tone MRU is referred to by seven RU Allocation subfields per EHT-SIG content channel, for both EHT-SIG content channels. The seven RU Allocation subfields per EHT-SIG content channel are labeled from the first RU Allocation subfield to the seventh RU Allocation subfield.

A 3-tone MRU is referred to by six RU Allocation subfields per EHT-SIG content channel, for both EHT-SIG content channels. The six RU Allocation subfields per EHT-SIG content channel are labeled from the first RU Allocation subfield to the sixth RU Allocation subfield.

A 2 tone MRU is referred to by five RU Allocation subfields per EHT-SIG content channel, for both EHT-SIG content channels. The five RU Allocation subfields per EHT-SIG content channel are labeled from the first RU Allocation subfield to the fifth RU Allocation subfield.

A 2-tone RU is referred to by four consecutive RU Allocation subfields per EHT-SIG content channel, for both EHT-SIG content channels. The four RU Allocation subfields per EHT-SIG content channel are labeled from the first RU Allocation subfield to the fourth RU Allocation subfield.

A 996+484 tone MRU is referred to by three RU Allocation subfields per EHT-SIG content channel, for both EHT-SIG content channels. The three RU Allocation subfields per EHT-SIG content channel are labeled from the first RU Allocation subfield to the third RU Allocation subfield.

A 996-tone RU is referred to by two consecutive RU Allocation subfields per EHT-SIG content channel, for both EHT-SIG content channels. The two consecutive RU Allocation subfields per EHT-SIG content channel are labeled the first RU Allocation subfield and the second RU Allocation subfield.

A 484242 tone MRU by two RU allocation subfields in the EHT-SIG content channel that overlaps with the 242-tone RU and one RU allocation subfield in the other EHT-SIG content channel. The two RU Allocation subfields in the EHT-SIG content channel (with two RU Allocation subfields) are labeled the first RU Allocation subfield and the second RU Allocation subfield.

NOTE 1—Although there may be two or more RU Allocation subfields per EHT-SIG content channel for the users of a RU size greater than 484 subcarriers, each user is described by only one User field, which is located in one EHT-SIG content channel.

A 484-tone RU is referred to by a single RU Allocation subfield per EHT-SIG content channel, for both EHT-SIG content channels.

Smaller RUs are referred to by a single RU Allocation subfield in a single EHT-SIG content channel.

For an RU that is referred to by a first or only RU Allocation subfield in an EHT-SIG content channel, the RU Allocation subfield encodes the number of User fields per RU contributed to the User Specific field in the same EHT-SIG content channel as the RU Allocation subfield. This number is labeled  for RU *r* and EHT-SIG content channel *c* as described in Table 36-22 (RU Allocation subfield).

For an RU that is referred to by two or more RU Allocation subfields in an EHT-SIG content channel (e.g., a 996-tone RU in a 160 MHz PPDU), the RU Allocation subfield other than the first one in the EHT-SIG content channel encodes zero additional User fields per RU contributed to the User Specific field in the same EHT-SIG content channel as the RU Allocation subfield.

In an EHT MU PPDU, an RU/MRU that is not allocated to a user can be indicated as follows:

* The RU Allocation subfield in the EHT-SIG Common field is set to 26 or27 (see Table 36-22 (RU Allocation subfield)).
* The STA-ID subfield in the EHT-SIG User field is set to 2046 for smaller than 242-tone RU (see 35.6.1.1 (STA\_ID) and 36.3.11.8.5 (User Specific field)).
* The RU Allocation subfield in the EHT-SIG Common field is set to 24 (see Table 36-22 (RU Allocation subfield)). In this case, the middle 26-tone RU is not allocated.

If an RU/MRU is an unallocated RU/MRU, zero users are allocated to it. Otherwise, the number of users allocated to RU/MRU *r* is determined from the RU/MRU size and *Nuser*(r, c) as follows:

* If RU/MRU *r* is a 26-tone RU, 52-tone RU, 106-tone RU, 26+52-tone MRU, or 26+106-tone MRU, then one user is allocated to the RU/MRU.
* If RU *r* is 242-tone RU, then the number of users allocated to the RU is *Nuser*(r, c).
* If RU/MRU *r* is a 484-tone or larger RU/MRU, then the number of users allocated to the RU/MRU equals the number of User fields for the RU/MRU summed across both EHT-SIG content channels, i.e., *Nuser*(r, 1)+ *Nuser*(r, 2).

NOTE 2—The exact dynamic split of User fields between the two content channels, *Nuser*(r, 1) and *Nuser*(r, 2), is not specified and might be used to reduce any disparity in the number of User fields between content channels.

NOTE 3—If the number of users per RU/MRU is greater than one, then the users in the RU/MRUs are multiplexed using MU-MIMO.

For RU/MRU larger than 484-tone RU, for each EHT-SIG content channel, the first 9-bit RU Allocation subfield referring to the RU/MRU may use values in the range of 80-303 (001010y2y1y0-100101y2y1y0 in binary representation) as in Table 36-22 (RU Allocation subfield) with y2y1y0 indicating the number of User fields signaled in the corresponding content channel, while the remaing 9-bit RU Allocation subfields referring to the RU/MRU shall be set as follows:

* For a 996-tone RU, the second 9-bit RU Allocation subfield referring to the RU shall be set to 30 (000011110 in binary representation), which encodes zero additional User fields in the corresponding content channel.
* The RU Allocation subfield corresponding to 242-tone RU in large-size MRU combinations of 484+242 tone MRU is set to 28 (000011100 in binary representation) to indicate the zero users, which encodes zero additional User fields in the corresponding content channel.
* The RU Allocation subfield corresponding to 484-tone RU in large-size MRU combinations of 484+242 tone MRU, 996+484 tone MRU, 2×996+484 tone MRU, and 3×996+484 tone MRU is set to 29 (000011101 in binary representation) to indicate the zero users, which encodes zero additional User fields in the corresponding content channel.
* The RU Allocation subfield corresponding to 996-tone RU in large-size MRU combinations of 996+484 tone MRU, 2×996+484 tone MRU, 3×996+484 tone MRU, 3×996-tone MRU, and 2×996-tone RU is set to 30 (000011110 in binary representation) to indicate the zero users, which encodes zero additional User fields in the corresponding content channel.

**Table 36-22—RUs associated with each RU Allocation subfield for each EHT-SIG content channel and PPDU bandwidth**

|  |  |  |
| --- | --- | --- |
| **PPDU bandwidth** | **RU Allocation subfield subfield** | **RUs in the subcarrier range, or overlapping with the subcarrier range if the RU is larger than a 242-tone RU** |
| 20 MHz | The RU Allocation subfield in a single EHT-SIG content channel | [–122:122] |
| 40 MHz | The RU Allocation subfield in EHT-SIG content channel 1 | [–244:–3] |
| The RU Allocation subfield in EHT-SIG content channel 2 | [3:244] |
| 80 MHz | The first RU Allocation subfield in EHT-SIG content channel 1 | [–500: –259] |
| The first RU Allocation subfield in EHT-SIG content channel 2 | [–253: –12] |
| The second RU Allocation subfield in EHT-SIG content channel 1 | [12: 253] |
| The second RU Allocation subfield in EHT-SIG content channel 2 | [259: 500] |
| 160 MHz | The first RU Allocation subfield in EHT-SIG content channel 1 | [–1012: –771] |
| The first RU Allocation subfield in EHT-SIG content channel 2 | [–765: –524] |
| The second RU Allocation subfield in EHT-SIG content channel 1 | [–500: –259] |
| The second RU Allocation subfield in EHT-SIG content channel 2 | [–253: –12] |
| The third RU Allocation subfield in EHT-SIG content channel 1 | [12: 253] |
| The third RU Allocation subfield in EHT-SIG content channel 2 | [259: 500] |
| The fourth RU Allocation subfield in EHT-SIG content channel 1 | [524: 765] |
| The fourth RU Allocation subfield in EHT-SIG content channel 2 | [771: 1012] |
| 320 MHz | The first RU Allocation subfield in EHT-SIG content channel 1 | [–2036: –1795] |
| The first RU Allocation subfield in EHT-SIG content channel 2 | [–1789: –1548] |
| The second RU Allocation subfield in EHT-SIG content channel 1 | [–1524: –1283] |
| The second RU Allocation subfield in EHT-SIG content channel 2 | [–1277: –1036] |
| The third RU Allocation subfield in EHT-SIG content channel 1 | [–1012: –771] |
| The third RU Allocation subfield in EHT-SIG content channel 2 | [–765: –524] |
| The fourth RU Allocation subfield in EHT-SIG content channel 1 | [–500: –259] |
| The fourth RU Allocation subfield in EHT-SIG content channel 2 | [–253: –12] |
| The fifth RU Allocation subfield in EHT-SIG content channel 1 | [12: 253] |
| The fifth RU Allocation subfield in EHT-SIG content channel 2 | [259: 500] |
| The sixth RU Allocation subfield in EHT-SIG content channel 1 | [524: 765] |
| The sixth RU Allocation subfield in EHT-SIG content channel 2 | [771: 1012] |
| The seventh RU Allocation subfield in EHT-SIG content channel 1 | [1036: 1277] |
| The seventh RU Allocation subfield in EHT-SIG content channel 2 | [1283: 1524] |
| The eighth RU Allocation subfield in EHT-SIG content channel 1 | [1548: 1789] |
| The eighth RU Allocation subfield in EHT-SIG content channel 2 | [1795: 2036] |

The mapping from the 9-bit RU Allocation subfield to the RU assignment and the number of User fields per RU or MRU contributed to the User Specific field in the same EHT-SIG content channel as the RU Allocation subfield is defined in the Table 36-23 (RU Allocation subfield).

***Instructions to the editor:***

***Please replace Table 36-24—RU Allocation subfield in P802.11be D0.2 with the following table***

**Table 36-23—RUs associated with each RU Allocation subfield for each EHT-SIG content channel and PPDU bandwidth**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU Allocation subfield  (B8 B7 B6 B5 B4 B3 B2 B1 B0)** | **#1** | **#2** | **#3** | **#4** | **#5** | **#6** | **#7** | **#8** | **#9** | **Number of entries** |
| 0 (000000000) | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| 1 (000000001) | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 52 | | 1 |
| 2 (000000010) | 26 | 26 | 26 | 26 | 26 | 52 | | 26 | 26 | 1 |
| 3 (000000011) | 26 | 26 | 26 | 26 | 26 | 52 | | 52 | | 1 |
| 4 (000000100) | 26 | 26 | 52 | | 26 | 26 | 26 | 26 | 26 | 1 |
| 5 (000000101) | 26 | 26 | 52 | | 26 | 26 | 26 | 52 | | 1 |
| 6 (000000110) | 26 | 26 | 52 | | 26 | 52 | | 26 | 26 | 1 |
| 7 (000000111) | 26 | 26 | 52 | | 26 | 52 | | 52 | | 1 |
| 8 (000001000) | 52 | | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| 9 (000001001) | 52 | | 26 | 26 | 26 | 26 | 26 | 52 | | 1 |
| 10 (000001010) | 52 | | 26 | 26 | 26 | 52 | | 26 | 26 | 1 |
| 11 (000001011) | 52 | | 26 | 26 | 26 | 52 | | 52 | | 1 |
| 12 (000001100) | 52 | | 52 | | 26 | 26 | 26 | 26 | 26 | 1 |
| 13 (000001101) | 52 | | 52 | | 26 | 26 | 26 | 52 | | 1 |
| 14 (000001110) | 52 | | 52 | | 26 | 52 | | 26 | 26 | 1 |
| 15 (000001111) | 52 | | 52 | | 26 | 52 | | 52 | | 1 |
| 16 (000010000) | 26 | 26 | 26 | 26 | 26 | 106 | | | | 1 |
| 17 (000010001) | 26 | 26 | 52 | | 26 | 106 | | | | 1 |
| 18 (000010010) | 52 | | 26 | 26 | 26 | 106 | | | | 1 |
| 19 (000010011) | 52 | | 52 | | 26 | 106 | | | | 1 |
| 20 (000010100) | 106 | | | | 26 | 26 | 26 | 26 | 26 | 1 |
| 21 (000010101) | 106 | | | | 26 | 26 | 26 | 52 | | 1 |
| 22 (000010110) | 106 | | | | 26 | 52 | | 26 | 26 | 1 |
| 23 (000010111) | 106 | | | | 26 | 52 | | 52 | | 1 |
| 24 (000011000) | 52 | | 52 | | - | 52 | | 52 | | 1 |
| 25 (000011001) | 106 | | | | 26 | 106 | | | | 1 |
| 26 (000011010) | Punctured 242-tone RU | | | | | | | | | 1 |
| 27 (000011011) | Unassigned 242-tone RU | | | | | | | | | 1 |
| 28 (000011100) | 242-tone RU; contributes zero User fields to the User Specific field in the same EHT-SIG content channel as this RU Allocation subfield and is not unallocated | | | | | | | | | 1 |
| 29 (000011101) | 484-tone RU; contributes zero User fields to the User Specific field in the same EHT-SIG content channel as this RU Allocation subfield and is not unallocated | | | | | | | | | 1 |
| 30 (000011110) | 996-tone RU; contributes zero User fields to the User Specific field in the same EHT-SIG content channel as this RU Allocation subfield and is not unallocated | | | | | | | | | **1** |
| 31 (000011111) | **Validate** | | | | | | | | | **1** |
| 32 (000100000) | 26 | 26 | 26 | 26 | 26 | 52+26 | | | 26 | 1 |
| 33 (000100001) | 26 | 26 | 52 | | 26 | 52+26 | | | 26 | 1 |
| 34 (000100010) | 52 | | 26 | 26 | 26 | 52+26 | | | 26 | 1 |
| 35 (000100011) | 52 | | 52 | | 26 | 52+26 | | | 26 | 1 |
| 36 (000100100) | 26 | 52+26 | | | 26 | 26 | 26 | 26 | 26 | 1 |
| 37 (000100101) | 26 | 52+26 | | | 26 | 26 | 26 | 52 | | 1 |
| 38 (000100110) | 26 | 52+26 | | | 26 | 52 | | 26 | 26 | 1 |
| 39 (000100111) | 26 | 52+26 | | | 26 | 52 | | 52 | | 1 |
| 40 (000101000) | 26 | 26 | 26 | 26 | 106+26 | | | | | 1 |
| 41 (000101001) | 26 | 26 | 52 | | 106+26 | | | | | 1 |
| 42 (000101010) | 52 | | 26 | 26 | 106+26 | | | | | 1 |
| 43 (000101011) | 52 | | 52 | | 106+26 | | | | | 1 |
| 44 (000101100) | 106+26 | | | | | 26 | 26 | 26 | 26 | 1 |
| 45 (000101101) | 106+26 | | | | | 26 | 26 | 52 | | 1 |
| 46 (000101110) | 106+26 | | | | | 52 | | 26 | 26 | 1 |
| 47 (000101111) | 106+26 | | | | | 52 | | 52 | | 1 |
| 48 (000110000) | 106+26 | | | | | 106 | | | | 1 |
| 49 (000110001) | 106+26 | | | | | 52+26 | | | 26 | 1 |
| 50 (000110010) | 106 | | | | 106+26 | | | | | 1 |
| 51 (000110011) | 26 | 52+26 | | | 106+26 | | | | | 1 |
| 52 (000110100) | 106 | | | | 26 | 52+26 | | | 26 | 1 |
| 53 (000110101) | 26 | 52+26 | | | 26 | 106 | | | | 1 |
| 54 (000110110) | 26 | 52+26 | | | 26 | 52+26 | | | 26 | 1 |
| 55 (000110111) | 52 | | 52+26 | | | 52 | | 52 | | 1 |
| 56-63 (000111000-000111111) | **Validate** | | | | | | | | | **8** |
| 64-71 (001000y2y1y0) | 242 | | | | | | | | | 8 |
| 72-79 (001001y2y1y0) | 484 | | | | | | | | | 8 |
| 80-87 (001010y2y1y0) | 996 | | | | | | | | | 8 |
| 88-95 (001011y2y1y0) | 2x996 | | | | | | | | | 8 |
| 96-103 (001100y2y1y0) | MRU of []-242-484 | | | | | | | | | 8 |
| 104-111 (001101y2y1y0) | MRU of 242-[]-484 | | | | | | | | | 8 |
| 112-119 (001110y2y1y0) | MRU of 484-[]-242 | | | | | | | | | 8 |
| 120-127 (001111y2y1y0) | MRU of 484-242-[] | | | | | | | | | 8 |
| 128-135 (010000y2y1y0) | MRU of []-484-996 | | | | | | | | | 8 |
| 136-143 (010001y2y1y0) | MRU of 484-[]-996 | | | | | | | | | 8 |
| 144-151 (010010y2y1y0) | MRU of 996-[]-484 | | | | | | | | | 8 |
| 152-159 (010011y2y1y0) | MRU of 996-484-[] | | | | | | | | | 8 |
| 160-167 (010100y2y1y0) | MRU of []-996-996-996 | | | | | | | | | 8 |
| 168-175 (010101y2y1y0) | MRU of 996-[]-996-996 | | | | | | | | | 8 |
| 176-183 (010110y2y1y0) | MRU of 996-996-[]-996 | | | | | | | | | 8 |
| 184-191 (010111y2y1y0) | MRU of 996-996-996-[] | | | | | | | | | 8 |
| 192-199 (011000y2y1y0) | MRU of []-484-996-996-996 | | | | | | | | | 8 |
| 200-207 (011001y2y1y0) | MRU of 484-[]-996-996-996 | | | | | | | | | 8 |
| 208-215 (011010y2y1y0) | MRU of 996-[]-484-996-996 | | | | | | | | | 8 |
| 216-223 (011011y2y1y0) | MRU of 996-484-[]-996-996 | | | | | | | | | 8 |
| 224-231 (011100y2y1y0) | MRU of 996-996-[]-484-996 | | | | | | | | | 8 |
| 232-239 (011101y2y1y0) | MRU of 996-996-484-[]-996 | | | | | | | | | 8 |
| 240-247 (011110y2y1y0) | MRU of 996-996-996-[]-484 | | | | | | | | | 8 |
| 248-255 (011111y2y1y0) | MRU of 996-996-996-484-[] | | | | | | | | | 8 |
| 256-263 (100000y2y1y0) | MRU of []-484-996-996 | | | | | | | | | 8 |
| 264-271 (100001y2y1y0) | MRU of 484-[]-996-996 | | | | | | | | | 8 |
| 272-279 (100010y2y1y0) | MRU of 996-[]-484-996 | | | | | | | | | 8 |
| 280-287 (100011y2y1y0) | MRU of 996-484-[]-996 | | | | | | | | | 8 |
| 288-295 (100100y2y1y0) | MRU of 996-996-[]-484 | | | | | | | | | 8 |
| 296-303 (100101y2y1y0) | MRU of 996-996-484-[] | | | | | | | | | 8 |
| 304-511 | **Disregard** | | | | | | | | | **208** |
| If signaling RUs or MRUs of size greater than or equal to 242 subcarriers, y2y1y0 = 000–111 indicates the number of User fields in the EHT-SIG content channel that contains the corresponding 9-bit RU Allocation subfield. The binary vector y2y1y0 indicates *Nuser*(r, c) = 22 × y2 + 21 × y1 + y0 + 1 users multiplexed in the RU. | | | | | | | | | | |

“Punctured 242-tone RU” shall be used when the preamble portion of corresponding 20 MHz is punctured In this case, corresponding 242-tone RU shall not not used for date transmissions.

“Unassigned 242-tone RU” shall be used when the preamble portion of corresponding 20 MHz is not puncturedand when corresponding 242-tone RU is not used for date transmission.

If the RU Allocation subfield carries the value of 31 or between 56 and 63, R1 devices can terminate reception.

If signaling R2 RUs or MRUs of value 304-511 (binary representation with y2y1y0 ending), y2y1y0 = 000–111 indicates the number of User fields in the EHT-SIG content channel that contains the corresponding 9-bit RU Allocation subfield. The binary vector y2y1y0 indicates *Nuser*(r, c) = 22 × y2 + 21 × y1 + y0 + 1 users multiplexed in the R2 RU(s) or MRU(s) indicated for this 20MHz. When R1 devices read the RU allocation subfield value of 304-511, they shall skip the number of User fields corresponding to the field value and continue to process the EHT-SIG.

If a single RU in a 40 MHz PPDU overlaps the subcarrier ranges [–244:–3] and [3:244], the corresponding RU Allocation subfields in the respective content channels shall both refer to the same RU.

If a single RU/MRU in an 80 MHz PPDU overlaps more than one of the subcarrier ranges [–500:–259], [–253: –12], [12: 253], or [259:500], the corresponding RU Allocation subfields in the respective content channels shall all refer to the same RU/MRU.

If a single RU/MRU in a 160 MHz PPDU overlaps more than one of the subcarrier ranges [–1012: –771], [–765: –524], [–500: –259], [–253: –12], [12: 253], [259: 500], [524: 765], or [771: 1012], the corresponding RU Allocation subfields in the respective content channels shall all refer to the same RU/MRU.

If a single RU/MRU in a 320 MHz PPDU overlaps more than one of the subcarrier [–2036: –1795], [–1789: –1548], [–1524: –1283], [–1277: –1036], [–1012: –771], [–765: –524], [–500: –259], [–253: –12], [12: 253], [259: 500], [524: 765], [771: 1012], [1036: 1277], [1283: 1524], [1548: 1789], or [1795: 2036], the corresponding RU Allocation subfields in the respective content channels shall all refer to the same RU/MRU.

In Table 36-23 (RU Allocation subfield), the number of entries column refers to the number of RU Allocation subfield values that refer to the same RU assignment to be used in the frequency domain but differ in the number of User fields per RU. The number of User fields per RU indicated by the RU Allocation subfields of an EHT-SIG content channel indicate the number of User fields in the User Specific field of the EHT-SIG content channel.

For an MU-MIMO allocation of RU/MRU size greater than 242 subcarriers, the dynamic split of User fields between EHT-SIG content channel 1 and EHT-SIG content channel 2 per 80 MHz is decided by the AP (on a per case basis) and signaled by the AP using the RU Allocation subfields in each EHT-SIG content channel. See Annex TBD for examples.

The pre-EHT modulated fields (see Figure 36-33 (Timing boundaries for EHT PPDU fields if midamble is not present (TBD))) are not transmitted in 20 MHz subchannels in which the preamble is punctured.

* Common field for non-OFDMA transmission

The Common field for non-OFDMA transmission to a single user, and non-OFDMA transmission to multiple uses is defined in Table 36-23 (non-OFDMA transmission to a single user and non-OFDMA transmission to multiple users)).

Table 36-23 Common field for non-OFDMA transmission to a single user and non-OFDMA transmission to multiple users

|  |  |  |  |
| --- | --- | --- | --- |
| Bit | Subfield | Number of bits | Description |
| B0-B3 | Spatial reuse | 4 | Indicates spatial reuse paramters during the transmission of this PPDU. |
| B4-B5 | GI+LTF size | 2 | Indicates the GI duration and EHT-LTF size:  set to 0 to indicate 2x LTF + 0.8us GI ;  set to 1 to indicate 2x LTF + 1.6us GI;  set to 2 to indicate 4x LTF + 0.8us GI  set to 3 to indicate 4x LTF + 3.2us GI; |
| B6-B8 | Number of EHT-LTF symbols | 3 | Indicates the number of EHT-LTF symbols:  set to 0 to indicate 1 EHT-LTF symbol;  set to 1 to indicate 2 EHT-LTF symbols;  set to 2 to indicate 4 EHT-LTF symbols;  set to 3 to indicate 6 EHT-LTF symbols;  set to 4 to indicate 8 EHT-LTF symbols;  other values are reserved |
| B9 | LDPC extra symbol segment | 1 | Indicates the presence of the LDPC extra symbol segment:  Set to 1 if an LDPC extra symbol segment is present  Set to 0 if an LDPC extra symbol segment is not present. |
| B10-B11 | Pre-FEC padding factor | 2 | Indicates the pre-FEC padding factor.  Set to 0 to indicate a pre-FEC padding factor of 4  Set to 1 to indicate a pre-FEC padding factor of 1  Set to 2 to indicate a pre-FEC padding factor of 2  Set to 3 to indicate a pre-FEC padding factor of 3 |
| B12 | PE Disambiguity | 1 | Indicates PE disambiguity as defined in 36.3.13 (Packet extension). |
| B13-B16 | Disregard | 4 | Disregard and set to 1 |
| B17-B19 | Number Of Non-OFDMA Users | 3 | Indicates the number of non-OFDMA users.  Set to *n* to indicate *n*+1 non-OFDMA users. |
|  |  |  |  |
|  |  |  |  |

For non-OFDMA transmission to a single user, if BCC is applied, then LDPC extra symbol segment is set to 0 to indicate an LDPC extra symbol segment is not present.

The Common field for EHT Sounding NDP is defined in Table 36-23A (Common field for EHT Sounding NDP).

Table 36-23A Common field for EHT Sounding NDP

|  |  |  |  |
| --- | --- | --- | --- |
| Bit | Subfield | Number of bits per subfield | Description |
| B0-B3 | Spatial reuse | 4 | Indicates spatial reuse paramters during the transmission of this PPDU. |
| B4-B5 | GI+LTF size | 2 | Indicates the GI and size of EHT-LTF:  set to 0 to indicate 2x LTF + 0.8us GI ;  set to 1 to indicate 2x LTF + 1.6us GI;  value 2 is reserved.  set to 3 to indicate 4x LTF + 3.2us GI; |
| B6-B8 | Number of EHT-LTF symbols | 3 | Indicates the number of EHT-LTF symbols:  set to 0 to indicate 1 EHT-LTF symbol;  set to 1 to indicate 2 EHT-LTF symbols;  set to 2 to indicate 4 EHT-LTF symbols;  set to 3 to indicate 6 EHT-LTF symbols;  set to 4 to indicate 8 EHT-LTF symbols;  other values are reserved |
| B9-B12 | NSS | 4 | Indicates the number of spatial  Streams:  Set to the number of spatial streams minus 1 for up to 8 spatial streams;  other values are reserved. |
| B13 | Beamformed | 1 | Set to 1 if a beamforming steering matrix is applied to the EHT modulated fields.  Set to 0 otherwise.  If the Beamformed field in EHT-SIG of an EHT sounding NDP is 1, then the receiver of the EHT sounding NDP should not perform channel smoothing when generating the compressed beamforming feedback report. |
| B14-B15 | Disregard | 2 | Disregard |
| B16-B19 | CRC | 4 | CRC for bits 0–15 of the EHT-SIG field (see 27.3.11.7.3 (CRC computation)).  The CRC is calculated over bits B0-B15 |
| B20-B25 | Tail | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0 |

* User Specific field

The User Specific field of an EHT-SIG content channel consists of zero or more User Block fields followed by padding (if present) as shown in Figure 36-35 (EHT-SIG content channel format for OFDMA transmission if BW is 20/40/80 MHz, Figure 36-36 (EHT-SIG content channel format for OFDMA transmission if BW is 160MHz), and Figure 36-37 (EHT-SIG content channel format for OFDMA transmission if BW is 320MHz). For OFDMA transmission, each non-final User Block field is made up of two User fields that contain information for two STAs that is used to decode their payloads. The final User Block field contains information for one or two users depending on the number of users in the EHT-SIG content channel. For OFDMA transmission, the number of User fields is indicated by the RU Allocation subfields. For non-OFDMA transmission to a single user and non-OFDMA transmission to multiple users, the User Block field is made using the same method as the OFDMA transmission by using the remaining User fields except for the first User field. And, the first User field is made of encoding block with the common field~~it is TBD.~~ For non-OFDMA transmission to a single user and non-OFDMA transmission to multiple users, the number of User field is indicated by the Number of Non-OFDMA Users subfield. The EHT sounding NDP does not contain the User field.

For non-OFDMA transmission to a single user and non-OFDMA transmission to multiple users, the Common field of the EHT-SIG content channel is encoded together with the first user field. This encoding block contains of CRC and Tail, and is the first encoding block in EHT-SIG for non-OFDMA transmission to a single user and multiple users. The contents of the first encoding block in EHT-SIG for non-OFDMA transmission to a single user and multiple users are defined in Table 36-24A (The first encoding block in EHT-SIG for non-OFDMA transmission to a single user and multiple users)

Table 36-24A -- The first encoding block in EHT-SIG for non-OFDMA transmission to a single user and multiple users

|  |  |  |  |
| --- | --- | --- | --- |
| Bit | Subfield | Number of bits per field | Description |
| B0-B19 | Common field for non-OFDMA transmission to a single user and non-OFDMA transmission to multiple users | 20 | The Common field for non-OFDMA transmission to a single user and non-OFDMA transmission to multiple users is defined in Table 36-23. |
| B20-B41 | User field | 22 | The User field format for a non-MU-MIMO allocation is defined in Table 36-25 (User field format for a non-MU-MIMO allocation). The User field format for a MU-MIMO allocation is defined in Table 36-26 (User field format for a MU-MIMO allocation). |
| B42-B45 | CRC | 4 | The CRC is calculated over bits 0 to 41. See 36.3.11.7.3 (CRC computation). |
| B46-B51 | Tail | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0. |

The User Block field is defined in Table 36-24 (User Block field).

|  |  |  |  |
| --- | --- | --- | --- |
| * User Block field | | | |
| Subfield | Number of fields | Number of bits per field | Description |
| User field | *N* | 22~~TBD~~ | *N* User fields are present, where:  *N*= 1 if it is the final User Block field, and if there is only one user in the final User Block field.  *N*= 2 otherwise.  The User field format for a non-MU-MIMO allocation is defined in Table 36-25 (User field format for a non-MU-MIMO allocation). The User field format for a MU-MIMO allocation is defined in Table 36-26 (User field format for a MU-MIMO allocation). |
| CRC | 1 | 4 | The CRC is calculated over bits 0 to 22~~TBD~~ for a User Block field that contains one User field, and bits 0 to 44~~TBD~~ for a User Block field that contains two User fields. See 36.3.11.7.3 (CRC computation). |
| Tail | 1 | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0. |

The contents of the User field differ depending on whether the field addresses a user in a non-MU-MIMO allocation in an RU or a user in an MU-MIMO allocation in an RU. For EHT-MU PPDU sent to a single user, the User field format for a non-MU-MIMO allocation is used.

The User field format for a non-MU-MIMO allocation is defined in Table 36-25 (User field format for a non-MU-MIMO allocation).

|  |  |  |  |
| --- | --- | --- | --- |
| * User field format for a non-MU-MIMO allocation | | | |
| Bit | Subfield | Number of bits | Description |
| B0–B10 ~~TBD~~ | STA-ID | 11 ~~TBD~~ | Indicate the STA-ID related information. |
| B11–B14 | MCS | 4 | If the STA-ID subfield is not 2046, indicates the modulation  and coding scheme:  Set to n for EHT-MCS n, where n = 0, 1, 2, …, 13 and 15  Values 14 is not used.  Set to an arbitrary value if the STA-ID subfield is 2046 |
| B15 | Reserved | 1 | Reserved and set to 1.  If the AID matches, and bit set incorrectly, Terminate. If AID doesn’t match, all reserved bit in that user field are Don’t care |
| B16- B19 | NSTS | 4 | Indicate the number of space-time streams i.e., 1 to 16 streams and is set to the number of space-time streams minus 1. |
| B20 | Beamformed | 1 | If the STA-ID subfield is not 2046, used in transmit  beamforming:  Set to 1 if a beamforming steering matrix is applied to the waveform in a non-MU-MIMO allocation.  Set to 0 otherwise.  Set to an arbitrary value if the STA-ID subfield is 2046 |
| B21 | Coding | 1 | If the STA-ID subfield is not 2046, indicates whether  BCC or LDPC is used:  Set to 0 for BCC  Set to 1 for LDPC  Set to an arbitrary value if the STA-ID subfield is 2046. |

The User field format for an MU-MIMO allocation is defined in Table 36-26 (User field format for a MU-MIMO allocation).

|  |  |  |  |
| --- | --- | --- | --- |
| * User field format for a MU-MIMO allocation | | | |
| Bit | Subfield | Number of bits | Description |
| B0–B10 ~~TBD~~ | STA-ID | 11~~TBD~~ | Indicate the STA-ID related information. |
| B11–B14 | MCS | 4 | If the STA-ID subfield is not 2046, indicates the modulation  and coding scheme:  Set to n for EHT-MCS n, where n = 0, 1, 2, …, 13  Values 14 and 15 are not used.  Set to an arbitrary value if the STA-ID subfield is 2046 |
| B15 | Coding | 1 | If the STA-ID subfield is not 2046, indicates whether  BCC or LDPC is used:  Set to 0 for BCC  Set to 1 for LDPC  Reserved if RU size is larger than 242  Set to an arbitrary value if the STA-ID subfield is 2046. |
| B16–B21~~TBD~~ | Spatial Configuration | 6 | Indicates the number of spatial streams for a user in an MU-MIMO allocation (see Table 36-27 (Spatial Configuration subfield encoding)). |

A User field for an MU-MIMO allocation includes a 6-bit Spatial Configuration subfield that indicates the number of spatial streams for each user and the total number of spatial streams in the MU-MIMO allocation. The subfield shown in Table 36-27 (Spatial Configuration subfield encoding) is constructed by using the entries corresponding to the value of number of users  multiplexed using MU-MIMO in an RU.

For OFDMA transmission, and if MU-MIMO is used in RU of size greater than or equal to 242 subcarriers, the number of users  in MU-MIMO allocation is equal to the number of User fields per RU signaled for the RU in the associated RU Allocation subfield of the Common field in the same EHT-SIG content channel.

The positions of the User field within an RU are defined to be logically continuous: the last User field corresponding to an RU in EHT-SIG content channel 1 is immediately followed by the first User field corresponding to the same RU in EHT-SIG content channel 2.

For a given value of , the six bits of the Spatial Configuration subfield are used as follows: A STA with a STA-ID that matches the 11~~TBD~~-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 6-bit Spatial Configuration subfield and the column corresponding to the User field position in the User Specific field. The starting stream index for the user is computed by summing the  in the columns prior to the column indicated by the user’s User field position.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * Spatial Configuration subfield encoding | | | | | | | | | | | |
| *Nuser* | B5…B0 | *NSTS*[1] | *NSTS*[2] | *NSTS*[3] | *NSTS*[4] | *NSTS*[5] | *NSTS*[6] | *NSTS*[7] | *NSTS*[8] | Total *NSTS* | Total entries |
| 2 | 000000–000011 | 1–4 | 1 |  |  |  |  |  |  | 2–5 | 10 |
| 000100–000110 | 2–4 | 2 |  |  |  |  |  |  | 4–6 |
| 000111–001000 | 3–4 | 3 |  |  |  |  |  |  | 6–7 |
| 001001 | 4 | 4 |  |  |  |  |  |  | 8 |
| 3 | 000000–000011 | 1–4 | 1 | 1 |  |  |  |  |  | 3–6 | 20 |
| 000100–000110 | 2–4 | 2 | 1 |  |  |  |  |  | 5–7 |
| 000111–001000 | 3–4 | 3 | 1 |  |  |  |  |  | 7–8 |
| 001001 | 4 | 4 | 1 |  |  |  |  |  | 9 |
| 001010–001100 | 2–4 | 2 | 2 |  |  |  |  |  | 6–8 |
| 001101–001110 | 3–4 | 3 | 2 |  |  |  |  |  | 8–9 |
| 001111 | 4 | 4 | 2 |  |  |  |  |  | 10 |
| 010000–010001 | 3–4 | 3 | 3 |  |  |  |  |  | 9–10 |
| 010010 | 4 | 4 | 3 |  |  |  |  |  | 11 |
| 010011 | 4 | 4 | 4 |  |  |  |  |  | 12 |
| 4 | 000000–000011 | 1–4 | 1 | 1 | 1 |  |  |  |  | 4–7 | 35 |
| 000100–000110 | 2–4 | 2 | 1 | 1 |  |  |  |  | 6–8 |
| 000111–001000 | 3–4 | 3 | 1 | 1 |  |  |  |  | 8–9 |
| 001001 | 4 | 4 | 1 | 1 |  |  |  |  | 10 |
| 001010–001100 | 2–4 | 2 | 2 | 1 |  |  |  |  | 7–9 |
| 001101–001110 | 3–4 | 3 | 2 | 1 |  |  |  |  | 9–10 |
| 001111 | 4 | 4 | 2 | 1 |  |  |  |  | 11 |
| 010000–010001 | 3–4 | 3 | 3 | 1 |  |  |  |  | 10–11 |
| 010010 | 4 | 4 | 3 | 1 |  |  |  |  | 12 |
| 010011 | 4 | 4 | 4 | 1 |  |  |  |  | 13 |
| 010100–010110 | 2–4 | 2 | 2 | 2 |  |  |  |  | 8–10 |
| 010111–011000 | 3–4 | 3 | 2 | 2 |  |  |  |  | 10–11 |
| 011001 | 4 | 4 | 2 | 2 |  |  |  |  | 12 |
| 011010–011011 | 3–4 | 3 | 3 | 2 |  |  |  |  | 11–12 |
| 011100 | 4 | 4 | 3 | 2 |  |  |  |  | 13 |
| 011101 | 4 | 4 | 4 | 2 |  |  |  |  | 14 |
| 011110–011111 | 3–4 | 3 | 3 | 3 |  |  |  |  | 12–13 |
| 100000 | 4 | 4 | 3 | 3 |  |  |  |  | 14 |
| 100001 | 4 | 4 | 4 | 3 |  |  |  |  | 15 |
| 100010 | 4 | 4 | 4 | 4 |  |  |  |  | 16 |
| 5 | 000000–000011 | 1–4 | 1 | 1 | 1 | 1 |  |  |  | 5–8 | 49 |
| 000100–000110 | 2–4 | 2 | 1 | 1 | 1 |  |  |  | 7–9 |
| 000111–001000 | 3–4 | 3 | 1 | 1 | 1 |  |  |  | 9–10 |
| 001001 | 4 | 4 | 1 | 1 | 1 |  |  |  | 11 |
| 001010–001100 | 2–4 | 2 | 2 | 1 | 1 |  |  |  | 8–10 |
| 001101–001110 | 3–4 | 3 | 2 | 1 | 1 |  |  |  | 10–11 |
| 001111 | 4 | 4 | 2 | 1 | 1 |  |  |  | 12 |
| 010000–010001 | 3–4 | 3 | 3 | 1 | 1 |  |  |  | 11–12 |
| 010010 | 4 | 4 | 3 | 1 | 1 |  |  |  | 13 |
| 010011 | 4 | 4 | 4 | 1 | 1 |  |  |  | 14 |
| 010100–010110 | 2–4 | 2 | 2 | 2 | 1 |  |  |  | 9–11 |
| 010111–011000 | 3–4 | 3 | 2 | 2 | 1 |  |  |  | 11–12 |
| 011001 | 4 | 4 | 2 | 2 | 1 |  |  |  | 13 |
| 011010–011011 | 3–4 | 3 | 3 | 2 | 1 |  |  |  | 12–13 |
| 011100 | 4 | 4 | 3 | 2 | 1 |  |  |  | 14 |
| 011101 | 4 | 4 | 4 | 2 | 1 |  |  |  | 15 |
| 011110–011111 | 3–4 | 3 | 3 | 3 | 1 |  |  |  | 13–14 |
| 100000 | 4 | 4 | 3 | 3 | 1 |  |  |  | 15 |
| 100001 | 4 | 4 | 4 | 3 | 1 |  |  |  | 16 |
| 100010–100100 | 2–4 | 2 | 2 | 2 | 2 |  |  |  | 10–12 |
| 100101–100110 | 3–4 | 3 | 2 | 2 | 2 |  |  |  | 12–13 |
| 100111 | 4 | 4 | 2 | 2 | 2 |  |  |  | 14 |
| 101000–101001 | 3–4 | 3 | 3 | 2 | 2 |  |  |  | 13–14 |
| 101010 | 4 | 4 | 3 | 2 | 2 |  |  |  | 15 |
| 101011 | 4 | 4 | 4 | 2 | 2 |  |  |  | 16 |
| 5 | 101100–101101 | 3–4 | 3 | 3 | 3 | 2 |  |  |  | 14–15 | 49 |
| 101110 | 4 | 4 | 3 | 3 | 2 |  |  |  | 16 |
| 101111–110000 | 3–4 | 3 | 3 | 3 | 3 |  |  |  | 15–16 |
| 6 | 000000–000011 | 1–4 | 1 | 1 | 1 | 1 | 1 |  |  | 6–9 | 54 |
| 000100–000110 | 2–4 | 2 | 1 | 1 | 1 | 1 |  |  | 8–10 |
| 000111–001000 | 3–4 | 3 | 1 | 1 | 1 | 1 |  |  | 10–11 |
| 001001 | 4 | 4 | 1 | 1 | 1 | 1 |  |  | 12 |
| 001010–001100 | 2–4 | 2 | 2 | 1 | 1 | 1 |  |  | 9–11 |
| 001101–001110 | 3–4 | 3 | 2 | 1 | 1 | 1 |  |  | 11–12 |
| 001111 | 4 | 4 | 2 | 1 | 1 | 1 |  |  | 13 |
| 010000–010001 | 3–4 | 3 | 3 | 1 | 1 | 1 |  |  | 12–13 |
| 010010 | 4 | 4 | 3 | 1 | 1 | 1 |  |  | 14 |
| 010011 | 4 | 4 | 4 | 1 | 1 | 1 |  |  | 15 |
| 010100–010110 | 2–4 | 2 | 2 | 2 | 1 | 1 |  |  | 10–12 |
| 010111–011000 | 3–4 | 3 | 2 | 2 | 1 | 1 |  |  | 12–13 |
| 011001 | 4 | 4 | 2 | 2 | 1 | 1 |  |  | 14 |
| 011010–011011 | 3–4 | 3 | 3 | 2 | 1 | 1 |  |  | 13–14 |
| 011100 | 4 | 4 | 3 | 2 | 1 | 1 |  |  | 15 |
| 011101 | 4 | 4 | 4 | 2 | 1 | 1 |  |  | 16 |
| 011110–011111 | 3–4 | 3 | 3 | 3 | 1 | 1 |  |  | 14–15 |
| 100000 | 4 | 4 | 3 | 3 | 1 | 1 |  |  | 16 |
| 100001–100011 | 2–4 | 2 | 2 | 2 | 2 | 1 |  |  | 11–13 |
| 100100–100101 | 3–4 | 3 | 2 | 2 | 2 | 1 |  |  | 13–14 |
| 100110 | 4 | 4 | 2 | 2 | 2 | 1 |  |  | 15 |
| 6 | 100111–101000 | 3–4 | 3 | 3 | 2 | 2 | 1 |  |  | 14–15 | 54 |
| 101001 | 4 | 4 | 3 | 2 | 2 | 1 |  |  | 16 |
| 101010– 101011 | 3–4 | 3 | 3 | 3 | 2 | 1 |  |  | 15–16 |
| 101100 | 3 | 3 | 3 | 3 | 3 | 1 |  |  | 16 |
| 101101–101111 | 2–4 | 2 | 2 | 2 | 2 | 2 |  |  | 12–14 |
| 110000–110001 | 3–4 | 3 | 2 | 2 | 2 | 2 |  |  | 14–15 |
| 110010 | 4 | 4 | 2 | 2 | 2 | 2 |  |  | 16 |
| 110011–110100 | 3–4 | 3 | 3 | 2 | 2 | 2 |  |  | 15–16 |
| 110101 | 3 | 3 | 3 | 3 | 2 | 2 |  |  | 16 |
| 7 | 000000–000011 | 1–4 | 1 | 1 | 1 | 1 | 1 | 1 |  | 7–10 | 50 |
| 000100–000110 | 2–4 | 2 | 1 | 1 | 1 | 1 | 1 |  | 9–11 |
| 000111–001000 | 3–4 | 3 | 1 | 1 | 1 | 1 | 1 |  | 11–12 |
| 001001 | 4 | 4 | 1 | 1 | 1 | 1 | 1 |  | 13 |
| 001010–001100 | 2–4 | 2 | 2 | 1 | 1 | 1 | 1 |  | 10–12 |
| 001101–001110 | 3–4 | 3 | 2 | 1 | 1 | 1 | 1 |  | 12–13 |
| 001111 | 4 | 4 | 2 | 1 | 1 | 1 | 1 |  | 14 |
| 010000–010001 | 3–4 | 3 | 3 | 1 | 1 | 1 | 1 |  | 13–14 |
| 010010 | 4 | 4 | 3 | 1 | 1 | 1 | 1 |  | 15 |
| 010011 | 4 | 4 | 4 | 1 | 1 | 1 | 1 |  | 16 |
| 010100–010110 | 2–4 | 2 | 2 | 2 | 1 | 1 | 1 |  | 11–13 |
| 010111-011000 | 3–4 | 3 | 2 | 2 | 1 | 1 | 1 |  | 13–14 |
| 011001 | 4 | 4 | 2 | 2 | 1 | 1 | 1 |  | 15 |
| 011010-011011 | 3–4 | 3 | 3 | 2 | 1 | 1 | 1 |  | 14–15 |
| 011100 | 4 | 4 | 3 | 2 | 1 | 1 | 1 |  | 16 |
| 7 | 011101–011110 | 3–4 | 3 | 3 | 3 | 1 | 1 | 1 |  | 15–16 | 50 |
| 011111–100001 | 2–4 | 2 | 2 | 2 | 2 | 1 | 1 |  | 12–14 |
| 100010–100011 | 3–4 | 3 | 2 | 2 | 2 | 1 | 1 |  | 14–15 |
| 100100 | 4 | 4 | 2 | 2 | 2 | 1 | 1 |  | 16 |
| 100101–100110 | 3–4 | 3 | 3 | 2 | 2 | 1 | 1 |  | 15–16 |
| 100111 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |  | 16 |
| 101000–101010 | 2–4 | 2 | 2 | 2 | 2 | 2 | 1 |  | 13–15 |
| 101011–101100 | 3–4 | 3 | 2 | 2 | 2 | 2 | 1 |  | 15–16 |
| 101101 | 3 | 3 | 3 | 2 | 2 | 2 | 1 |  | 16 |
| 101110–110000 | 2–4 | 2 | 2 | 2 | 2 | 2 | 2 |  | 14–16 |
| 110001 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |  | 16 |
| 8 | 000000–000011 | 1–4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8–12 | 41 |
| 000100–000110 | 2–4 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 10–12 |
| 000111–001000 | 3–4 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 12–13 |
| 001001 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 14 |
| 001010–001100 | 2–4 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 11–13 |
| 001101–001110 | 3–4 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 13–14 |
| 001111 | 4 | 4 | 2 | 1 | 1 | 1 | 1 | 1 | 15 |
| 010000–010001 | 3–4 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 13–14 |
| 010010 | 4 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 16 |
| 010011–010101 | 2–4 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 12–14 |
| 010110–010111 | 3–4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 14–15 |
| 011000 | 4 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | 16 |
| 011001–011010 | 3–4 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 15–16 |
| 8 | 011011 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 16 | 41 |
| 011100–011110 | 2–4 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 13–15 |
| 011111–100000 | 3–4 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 15–16 |
| 100001 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 16 |
| 100010–100100 | 2–4 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 14–16 |
| 100101 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 16 |
| 100110–100111 | 2–3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 15–16 |
| 101000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 16 |

The user ordering identified by the column headers  in Table 36-27 (Spatial Configuration subfield encoding) shall be the same as the user index *u*,  in Equation (36-39), Equation TBD (corresponding to EHT-LTF), and Equation (36-79)-~~TBD~~ ~~corresponding to EHT-Data~~, i.e., .

The total number of spatial streams (total ) is computed by summing all columns for the row signaled by the Spatial Configuration field and is indicated in Table 36-27 (Spatial Configuration subfield encoding) under the column Total .

* Encoding and modulation

For EHT-SIG for OFDMA transmission and EHT Sounding NDP, the Common field of each EHT-SIG content channel is included into one or two code blocks, each of which shall be BCC encoded at rate . For EHT-SIG SU or non-OFDMA MU-MIMO mode, the Common field of each EHT-SIG content channel, together with the only User field or the first User field of the User Specific field, is included into a single code block, which shall be BCC encoded at rate .

For EHT-SIG for OFDMA transmission and non-OFDMA transmission to multiple users, each User Block field in the User Specific field of each EHT-SIG content channel shall be BCC encoded at rate . For OFDMA transmission, if the number of User fields in an EHT-SIG content channel is odd, there is a single User field in the final User Block field. For non-OFDMA transmission, the first User field is encoded together with the Common field of EHT-SIG, if the number of User fields in an EHT-SIG content channel is even, there is a single User field in the final User Block field. CRC and tail bits are added immediately after the last User field in each User Block field.

Padding bits are appended immediately after the tail bits corresponding to the final User Block field in each EHT-SIG content channel to round up to the next multiple of number of data bits per EHT-SIG OFDM symbol.

The padding bits may be set to any value. Further padding bits are appended to each EHT-SIG content channel so that the number of OFDM symbols after encoding and modulation in different 20 MHz subchannels is the same and equal to the number of EHT-SIG symbols signalled in Number of EHT-SIG symbol Subfield in U-SIG. For the Common field and each User Block field, the information bits, tail bits and padding bits (if present) are BCC encoded at rate  using the encoder described in 17.3.5.6 (Convolutional encoder). If the coding rate of the EHT-SIG-MCS is not equal to 1/2, the convolutional encoder output bits for each field are concatenated, then the concatenated bit streams are punctured as described in 17.3.5.6 (Convolutional encoder).

The codes bits are interleaved as described in 36.3.12.5 (BCC interleavers). The interleaved bits are mapped to constellation points from the EHT-SIG-MCS specified in U-SIG and have pilots inserted following the steps described in 17.3.5.8 (Subcarrier modulation mapping) and 17.3.5.9 (Pilot subcarriers), respectively. Each EHT-SIG OFDM symbol shall have 52 data tones.

The guard interval used for each EHT-SIG OFDM symbol shall be 0.8 µs.

The number of OFDM symbols in the EHT-SIG field, denoted , shall be indicated in the Number Of EHT-SIG Symbols field in the U-SIG field of an EHT MU PPDU (see 36.3.11.7.2 (Content)).

In terms of EHT-SIG for OFDMA transmission, for EHT-SIG content channel *c* (*c* = 1 to 2) in 80 MHz frequency subblock *l*, the complex number assigned to the *k-*th data subcarrier of the *n-*th symbol is denoted . In terms of EHT-SIG for non-OFDMA transmission to multiple users, for EHT-SIG content channel *c* (*c* = 1 to 2), the complex number assigned to the *k-*th data subcarrier of the *n-*th symbol is denoted . In terms of EHT-SIG for non-OFDMA transmission to a single user, for a single EHT-SIG content channel, the complex number assigned to the *k-*th data subcarrier of the *n-*th symbol is denoted . The time domain waveform for the EHT-SIG field, transmitted on transmit chain , is given by Equation (36-22).

where

is given in Table 36-17 (Number of modulated subcarriers and guard interval duration values for pre-EHT modulated fields).

is the phase rotation value for EHT-SIG field PAPR reduction. If the EHT-SIG field is modulated with EHT-SIG-MCS TBD (MCS0 with DCM), . For all the other modulation schemes:

is defined in 36.3.11.5 (L-SIG).

for EHT-SIG for OFDMA transmission

for EHT-SIG non-OFDMA transmission to multiple users

for EHT-SIG transmission to a single user or EHT sounding NDP

are defined in 17.3.5.10 (OFDM modulation).

is the number of OFDM symbols in the EHT-SIG field

For EHT-SIG for OFDMA transmission and non-OFDMA transmission to multiple users, from Equation (36-22) and 36.3.11.8.2 (EHT-SIG content channels), a 20 MHz PPDU contains one EHT-SIG content channel as shown in Figure 36-36 (EHT-SIG content channel for a 20 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users).



**Figure 36-36 EHT-SIG content channel for a 20 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users**

For EHT-SIG for OFDMA transmission and non-OFDMA transmission to multiple users, from Equation (36-22) and 36.3.11.8.2 (EHT-SIG content channels), a 40 MHz PPDU contains two EHT-SIG content channels, each occupying a 20 MHz frequency segment as shown in Figure 36-37 (EHT-SIG content channel for a 40 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users).



**Figure 36-37 EHT-SIG content channel for a 40 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users**

For EHT-SIG for OFDMA transmission and non-OFDMA transmission to multiple users, from Equation (36-22) and 36.3.11.8.2 (EHT-SIG content channels), an 80 MHz PPDU contains two EHT-SIG content channels each of which is duplicated as shown in Figure 36-38 (EHT-SIG content channels and their duplication in an 80 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users).



**Figure 36-38 EHT-SIG content channels and their duplication in an 80 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users.**

If a RU or MRU for an allocation in an 80 MHz PPDU overlaps more than one of the subcarrier ranges [–500:–259], [–253:–12], [12:253] or [259:500], the corresponding RU Allocation subfields in the respective content channels shall all refer to the same RU or MRU.

If the PPDU BW subfield and Punctured Channel Indication subfield in the U-SIG field of an EHT MU PPDU (see Table 36-19 (U-SIG field of an EHT MU PPDU)) indicates 80 MHz and preamble is punctured, the mapping of the EHT-SIG content channels to 20 MHz subchannels shall be the same as for an 80 MHz PPDU (see Figure 36-38 (EHT-SIG content channels and their duplication in an 80 MHz PPDU), with the exception that punctured 20 MHz subchannels shall be excluded.

For EHT-SIG OFDMA transmission and non-OFDMA transmission to multiple users, from Equation (36-22) and 36.3.11.8.2 (EHT-SIG content channels), a 160 MHz PPDU contains four EHT-SIG content channels each of which are duplicated as shown in Figure 36-39 (EHT-SIG content channels and their duplication in a 160 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users). EHT-SIG content channels with the same index may carry different information in different 80 MHz frequency subblocks for EHT-SIG OFDMA transmission but shall carry same information in different 80 MHz frequency subblocks for EHT-SIG non-OFDMA transmission to multiple users.



**Figure 36-39 (EHT-SIG content channels and their duplication in a 160 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users)**

If a RU or MRU for an allocation in a 160 MHz PPDU overlaps more than one of the subcarrier ranges [–1012:–771], [–765:–524], [–500:–259], [–253:–12], [12:253], [259:500], [524:765] or [771:1012], the corresponding RU Allocation subfields in the respective content channels shall all refer to the same RU or MRU.

If the PPDU BW subfield and Punctured Channel Indication subfield in the U-SIG field of an EHT MU PPDU (see Table 36-19 (U-SIG field of an EHT MU PPDU)) indicates 160 MHz and preamble is punctured, the mapping of the EHT-SIG content channels to 20 MHz subchannels shall be the same as for a 160 MHz PPDU (see Figure 36-39 (EHT-SIG content channels and their duplication in a 160 MHz PPDU)), with the exception that punctured 20 MHz subchannels shall be excluded.

For EHT-SIG OFDMA transmission and non-OFDMA transmission to multipler users, from Equation (36-22) and 36.3.11.8.2 (EHT-SIG content channels), a 320 MHz PPDU contains eight EHT-SIG content channels each of which is duplicated as shown in Figure 36-40 (EHT-SIG content channels and their duplication in a 320 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users). EHT-SIG content channels with the same index may carry different information in different 80 MHz frequency subblocks for EHT-SIG for OFDMA trnasmission but shall carry same information in different 80 MHz frequency subblocks for EHT-SIG for non-OFDMA transmission to multipler users.



**Figure 36-40 (EHT-SIG content channels and their duplication in a 320 MHz PPDU for OFDMA transmission and non-OFDMA transmission to multiple users**

If a RU or MRU for an allocation in a 320 MHz PPDU overlaps more than one of the subcarrier ranges [-2036:-1795], [-1789:-1548], [-1524:-1283], [-1277,-1036], [–1012:–771], [–765:–524], [–500:–259], [–253:–12], [12:253], [259:500], [524:765], [771:1012], [1036:1277], [1283, 1524], [1548, 1789] or [1795: 2036], the corresponding RU Allocation subfields in the respective content channels shall all refer to the same RU or MRU. If the PPDU BW subfield and Punctured Channel Indication subfield in the U-SIG field of an EHT MU PPDU (see Table 36-19 (U-SIG field of an EHT MU PPDU)) indicates 320 MHz and preamble is punctured, the mapping of the EHT-SIG content channels to 20 MHz subchannels shall be the same as for a 320 MHz PPDU (see Figure 36-40 (EHT-SIG content channels and their duplication in a 320 MHz PPDU)), with the exception that punctured 20 MHz subchannels shall be excluded.

For EHT-SIG for non-OFDMA transmission to a single user or EHT sounding NDP, an EHT MU PPDU has a single EHT-SIG content channel regardless of PPDU bandwidth, which is duplicated on every 20 MHz subchannel.

For EHT-SIG for non-OFDMA transmission to a single user or EHT Sounding NDP, a 20 MHz PPDU contains one EHT-SIG content channel as shown in Figure 36-41 (EHT-SIG content channel for a 20 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP).



**Figure 36-41 EHT-SIG content channel for a 20 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP**

For EHT-SIG for non-OFDMA transmission to a single user or EHT Sounding NDP, a 40 MHz PPDU contains one EHT-SIG content channel as shown in Figure 36-42 (EHT-SIG content channel for a 40 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP).

**Figure 36-42 (EHT-SIG content channel for a 40 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP)**

For EHT-SIG for non-OFDMA transmission to a single user or EHT Sounding NDP, an 80 MHz PPDU contains one EHT-SIG content channel as shown in Figure 36-43 (EHT-SIG content channel for an 80 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP).

**Figure 36-43 (EHT-SIG content channel for an 80 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP)**

For EHT-SIG for non-OFDMA transmission to a single user or EHT Sounding NDP, a 160 MHz PPDU contains one EHT-SIG content channel as shown in Figure 36-44 (EHT-SIG content channel for a 160 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP).

**Figure 36-44 (EHT-SIG content channel for a 160 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP)**

For EHT-SIG for non-OFDMA transmission to a single user or EHT Sounding NDP, a 320 MHz PPDU contains one EHT-SIG content channel as shown in Figure 36-45 (EHT-SIG content channel for a 320 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP).

**Figure 36-45 (EHT-SIG content channel for a 320 MHz PPDU for non-OFDMA transmission to a single user or EHT Sounding NDP)**