IEEE P802.11
Wireless LANs

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| CRs for Subclasuse 28.3.8 and 28.5 |
| Date: 2017-03-03 |
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This document provides PHY resolutions for the following CIDs on Clause 28.3.8 and 28.5. The baseline for this comment resolution document is 802.11ax Draft 1.1.

* CIDs: 8863,4983,8864,8865,8866,8867,8868,8869,8870, 8871,8872,8874, 9550, 10036, 4985, 4989, 8875, 8877, 8878, 8879, 10037, 10209, 4986, 4987, 7500, 7501,9321, 10234, 7244, 7245, 7246, 7502

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

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| **CID** | **Clause** | **P** | **L** | **Comment** | **Proposed Change** | **Resolution** |
| 8863 | 28.3.8 | 256 | 61 | Rename the parameter T\_GI,LegacyPreamble | Use e.g. T\_GI,Pre-HE. Also replace all occurrences of T\_GI,Legacy in the current draft with the new term. | AcceptedAgree. Pre-HE is the more accurate term than legacy. TGax editor: please make the changes shown in 11-17/0316r0 for CID8863. |
| 4983 | 28.3.8 | 257 | 25 | Too vague | Prepend "OFDM". Append " of the Data field" | RevisedTGax editor: please make the changes shown in 11-17/0316r0 for CID4983. |
| 8864 | 28.3.8 | 257 | 4 | T\_GI,HE-LTF and T\_GI,Data reference parameters that are defined later | Move rows T\_GI,HE-LTF and T\_GI,Data to after row T\_GI4,Data | AcceptedTGax editor: please make the changes shown in 11-17/0316r0 for CID8864. |
| 8865 | 28.3.8 | 257 | 26 | Move reference ("see Table 28-14 ...") from column2 to column 3 | See comment | Accepted.TGax editor: please make the changes shown in 11-17/0316r0 for CID8865. |
| 8866 | 28.3.8 | 257 | 40 | Where is T\_GI\_SIG-A-R used? | Can this be removed? | Rejected.The constant is used by equation (28-117) in D1.0 |
| 8867 | 28.3.8 | 258 | 4 | Move N\_service and N\_tail to Table 28-12. They are not timing-related constants | See comment | Rejected.These two parameters also listed in the timing related parameter table in VHT clause. They have impacts to the timing. |
| 8868 | 28.3.8 | 258 | 7 | There is no need to define T\_SYML. All fields prior to HE-STF have a dedicated parameter for symbol duration (e.g. T\_L-STF, T\_L-LTF, ...) | Remove row "T\_SYML" | Rejected.Constant T\_SYML is used in the equations (e.g. Eq 28-16 in D10) in following text |
| 8869 | 28.3.8 | 258 | 16 | Add definition of "non-OFDMA HE PPDU" to definition section | See comment | RejcctedNon-OFDMA is already defined in subclause 3.2 P6L55 of D1.0 |
| 8870 | 28.3.8 | 258 | 43 | What's the use of the parameters N\_DC, N\_Guard,Left and N\_Guard,Right in Table 28-10. | Propose to delete | Rejected.N\_DC used in eq 28-21. N\_Guard,Left and N\_Guard,Right are provided for clarifity.  |
| 8871 | 28.3.8 | 259 | 34 | Where is N\_user,total defined? | Define before use | Revised.Definition added.TGax editor: please make the changes shown in 11-17/0316r0 for CID8871. |
| 8872 | 28.3.8 | 259 | 40 | First column says N\_CBPSS,u. Second column says N\_CBPSS,r,u. Which is it? | Clarify | Revised.Should be N\_CBPSS,u.TGax editor: please make the changes shown in 11-17/0316r0 for CID8872. |
| 8874 | 28.3.8 | 259 | 61 | There is no TXVECTOR parameter NUM\_RUS in Table 28-1 | Clarify value of N\_RU | RevisedNumber of RU can be derived from the RU\_ALLOCATION in TXVECTOR.TGax editor: please make the changes shown in 11-17/0316r0 for CID8874. |
| 9550 | 28.3.8 | 259 | 34 | Table 28-12, Explanation of N\_{CBPS}, N{CBPS, u}N\_{user, total} not deifned. | Define N\_{user, total}. | Revised. Definition added. TGax editor: please make the changes shown in 11-17/0316r0 for CID9550. |
| 10036 | 28.3.8 | 259 | 61 | There is no TXVECTOR parameter NUM\_RUS defined in the spec. If needed, add the descripion of the parameter of TXVECTOR parameter NUM\_RUS in Table 28-1 (TXVECTOR and RXVECTOR parameters) | As in the comment. | RevisedNumber of RU can be derived from the RU\_ALLOCATION in TXVECTORTGax editor: please make the changes shown in 11-17/0316r0 for CID10036. |
| 4985 | 28.3.8 | 260 | 57 | Kr definition is not clear | This is the set of used/non-zero subcarrier indices. Add "used" / "non-zero" | Accept.TGax editor: please make the changes shown in 11-17/0316r0 for CID4985. |
| 4989 | 28.3.8 | 260 | 55 | No formula for N\_HE\_SIGB | Add a formula for N\_HE\_SIGB (or a least min value of N\_HE\_SIGB given the number of users, the PPDU BW and the SIGB MCS), and xref it from here | Revised.The comment asks for formula for the number of HE-SIGB symbol. Add reference to the HE-SIG-B subclause. TGax editor: please make the changes shown in 11-17/0316r0 for CID4989. |
| 8875 | 28.3.8 | 260 | 6 | There is no TXVECTOR parameter NUM\_USERS\_TOTAL in Table 28-1 | Clarify value of NUM\_USERS\_TOTAL | Revised.Nuser,r can be derived from the TXVECTOR RU\_ALLOCATION TGax editor: please make the changes shown in 11-17/0316r0 for CID8875. |
| 8877 | 28.3.8 | 260 | 15 | Where is the value N\_STS as defined for MU PPDU used? | If not used, delete | RejectedN\_STS is used in eq 28-8 in D1.0. |
| 8878 | 28.3.8 | 260 | 18 | Clarify "total number" as "total number over all users in the RU" | See comment | Accepted.TGax editor: please make the changes shown in 11-17/0316r0 for CID8878. |
| 8879 | 28.3.8 | 260 | 38 | Where is the value N\_SS as defined for MU PPDU used? | If not used, delete | Rejected.N\_SS used in equation 28-61 in D1.0 |
| 10037 | 28.3.8 | 260 | 15 | add definition of max operation for HE MU PPDU in the Table 28-12 (definition could be placed in NOTE) for readers. | As in the comment. | Rejected.Max function has been used in the .11 baseline text. |
| 10209 | 28.3.8 | 260 | 6 | The TXVECTOR parameter NUM\_USERS\_TOTAL does not exist on Table 28-1 (TXVECTOR and RXVECTOR parameters) | Define the TXVECTOR parameter or revise the explanation of N\_{user,r}. | Revised.Nuser,r can be derived from the TXVECTOR RU\_ALLOCATION TGax editor: please make the changes shown in 11-17/0316r0 for CID10209. |
| 4986 | 28.3.8 | 261 | 10 | u,u should be u,u' | u,u should be u,u' | Revised.TGax editor: please make the changes shown in 11-17/0316r0 for CID4986. |
| 4987 | 28.3.8 | 261 | 10 | Mr,n is not diven an English meaning | Add something like "The number of stace time streams of users prior to user r in RU u" | Revised.Agree in principle. TGax editor: please make the changes shown in 11-17/0316r0 for CID4987. |

***To TGax editor: Please do a global search and replace the constant*** *TGI,*LegacyPreamble ***with*** *TGI,Pre-HE* ***(#CID8863)***

 ***To TGax editor: Please make the following changes to 28.3.8 (#CID 4983,8863,8864,8865)***

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| * Timing-related constants
 |
| Parameter | Values | Description |
|  | 312.5 kHz | Subcarrier frequency spacing for the pre-HE modulated fields. |
|  | 78.125 kHz | Subcarrier frequency spacing for the HE modulated fields. |
| *TDFT,*Pre-HE | 3.2 µs | IDFT/DFT period for the pre-HE modulated fields. |
| *TDFT,*HE | 12.8 µs | IDFT/DFT period for the HE Data field. |
| *TGI,Pre-HE* | 0.8 µs | Guard interval duration for the Pre-HE preamble, RL-SIG, HE-SIG-A and HE-SIG-B (#8863) |
| *TGI,*L-LTF | 1.6 µs | Guard interval duration for the L-LTF field. |
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| *TGI1,Data* | 0.8 µs | Base guard interval duration for the HE-Data field. |
| *TGI2,Data* | 1.6 µs | Double guard interval duration for the HE-Data field. |
| *TGI4,Data* | 3.2 µs | Quadruple guard interval duration for the HE-Data field. |
| *TGI,*HE-LTF | *TGI1,Data*, *TGI2,Data* or *TGI4,Data* depending on the GI used for data | Guard interval duration for the HE-LTF field, same as *TGI,Data*  (#8864) |
| *TGI,Data* | *TGI1,Data*, *TGI2,Data* or *TGI4,Data* depending on the GI used for data | Guard interval duration for the HE-Data field (#8864) |
| *TSYM1* | 13.6 µs = *TDFT,*HE + *TGI1,Data* = 1.0625 × *TDFT,HE*  | OFDM symbol duration with base GI |
| *TSYM2* | 14.4 µs = *TDFT,*HE + *TGI2,Data* = 1.125 × *TDFT,HE* | OFDM symbol duration with double GI |
| *TSYM4* | 16 µs = *TDFT,*HE + *TGI4,Data* = 1.25 × *TDFT,*HE | OFDM symbol duration with quadruple GI |
| *TSYM* | *TSYM1*, *TSYM2*, or *TSYM4* depending on the GI used () | OFDM symbol interval for HE PPDU fields (#4983). See Table 28-14 (Tone scaling factor and guard interval duration values for HE PPDU fields) (#8865) |
| *T*L-STF | 8 µs = 10 × *TDFT,*Pre-HE /4 | Non-HT Short Training field duration |
| *T*L-LTF | 8 µs = 2 × *TDFT,*Pre-HE + *TGI,*L-LTF | Non-HT Long Training field duration |
| *T*L-SIG | 4 µs | Non-HT SIGNAL field duration |
| *T*RL-SIG | 4 µs | Repeated non-HT SIGNAL field duration |
| *T*HE-SIG-A | 8 µs = 2 × 4 µs | HE-SIG-A field duration in an HE SU PPDU, HE MU PPDU and HE trigger-based PPDU |
| *T*HE-SIG-A-R | 16 µs = 4 × 4 µs | HE-SIG-A field duration in an HE extended range SU PPDU |
| *T*HE-STF-T | 8 µs = 5 × 1.6 µs | HE-STF field duration for an HE trigger-based PPDU |
| *T*HE-STF-NT | 4 µs = 5 × 0.8 µs | HE-STF field duration for an HE SU PPDU, HE extended range SU PPDU and HE MU PPDU |
| *T*HE-LTF-1X | 3.2 µs | Duration of each 1x HE-LTF OFDM symbol without GI |
| *T*HE-LTF-2X | 6.4 µs | Duration of each 2x HE-LTF OFDM symbol without GI |
| *T*HE-LTF-4X | 12.8 µs | Duration of each 4x HE-LTF OFDM symbol without GI |
| *T*HE-LTF | *T*HE-LTF-1X, *T*HE-LTF-2X or *T*HE-LTF-4X depending upon the LTF duration used | Duration of each OFDM symbol without GI in the HE-LTF field  |
| *T*HE-LTF-SYM | sum of *T*HE-LTF and *TGI,*HE-LTF | Duration of each OFDM symbol including GI in the HE-LTF field |
| *T*HE-SIG-B | 4 µs = *TDFT,*Pre-HE + *TGI,*LegacyPreamble | Duration of each OFDM symbol in the HE-SIG-B field |
| *Nservice* | 16 | Number of bits in the SERVICE field |
| *Ntail* | 6 for BCC encoder, 0 for LDPC encoder | Number of tail bits per encoder |
| *TSYML* | 4 µs | Symbol duration including GI prior to the HE-STF field |
| *TPE* | 0, 4 µs, 8 µs, 12 µs or 16 µs depending on the actual extension duration used | Duration of the Packet Extension field |

***To TGax editor: Please make the following changes to 28.3.8 (#CID 8871, 8872, 8874, 9550, 10036, 4985, 4889, 8875, 8878, 10209, 4986, 4987))***

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| * Frequently used parameters
 |
| Symbol | Explanation |
| ***NCBPS, NCBPS,u*** | **Number of coded bits per symbol for user *u*, *u* = 0, ..., *Nuser,total* – 1, where *Nuser,total* is the total number of users in a HE transmission (#8871, #9550)****For an HE SU PPDU, *NCBPS* = *NCBPS,0*****For an HE MU PPDU, *NCBPS* is undefined** |
| *NCBPSS, NCBPSS,u* | Number of coded bits per symbol per spatial stream.For the Data field, *NCBPSS, u* (#8872) equals the number of coded bits per symbol per spatial stream for user *u*, *u* = 0, ..., *Nuser,total* – 1.For the Data field of an HE SU PPDU, *NCBPSS = NCBPSS,0*For the Data field of an HE MU PPDU, *NCBPSS* is undefined |
| *NDBPS, NDBPS,u* | Number of data bits per symbol for user *u*, *u* = 0, ..., *Nuser,total* – 1.For an HE SU PPDU, *NDBPS* = *NDBPS,0*For an HE MU PPDU, *NDBPS* is undefined |
| *NBPSCS, NBPSCS,u* | Number of coded bits per subcarrier per spatial stream for user *u*, *u* = 0, ..., *Nuser,total* – 1.For an HE SU PPDU, *NBPSCS* = *NBPSCS,0*For an HE MU PPDU, *NBPSCS* is undefined |
| *NRX* | Number of receive chains |
| *NRU* | For pre-HE modulated fields, *NRU* = 1. For HE modulated fields, *NRU* represents the number of RUs in the transmission which can be derived from the TXVECTOR RU\_ALLOCATION. (#8874,10036) |
| *Nuser,r* | For pre-HE modulated fields, *Nuser,r* = 1. For HE modulated fields, *Nuser,r* represents the total number of users in the *r*-th RU of the transmission which can be derived from the TXVECTOR RU\_ALLOCATION. (#8875, #10209)  |
| *NSTS*, *NSTS,r,u* | For pre-HE modulated fields, *NSTS,r,u* = 1 (see NOTE). For HE modulated fields, *NSTS,r,u* represents the number of space-time streams at *r*-th RU for user *u*, *u* = 0, ..., *Nuser,r* – 1. In case of STBC, *NSTS,r,u* = 2For an HE SU PPDU, *NSTS* = *NSTS,0,0*For an HE MU PPDU,  |
| *NSTS,r,total* | For HE modulated fields, *NSTS,r,total* is the total number of space-time streams over all the users (#8878) at the *r*-th RU in a PPDU. For pre-HE modulated fields, *NSTS,r,total* is undefined when the TXVECTOR parameter BEAM\_CHANGE is 1 and *NSTS,r,total* = *NSTS* when BEAM\_CHANGE is 0.Note that *NSTS,r,total* = *NSTS* for an HE SU PPDU. |
| *NSS*, *NSS,r,u*, *NSS,u* | Number of spatial streams. For the Data field, *NSS,r,u* is the number of spatial streams at *r*-th RU for user *u*, *u* = 0, ..., *Nuser,r* – 1 and *NSS,u* is the number of spatial streams for user *u*, *u* = 0, ..., *Nuser,total* – 1.For the Data field of an HE SU PPDU, *NSS* = *NSS,0,0*For the Data field of an HE MU PPDU,  |
| *NSS,r,total* | For HE modulated fields, *NSS,r,total* is the total number of spatial streams at *r*-th RU in a PPDU.For pre-HE modulated fields, *NSS,r,total* is undefined.Note that *NSS,r,total* = *NSS* for an HE SU PPDU. |
| *NTX* | Number of transmit chains |
| *NHE-LTF* | The number of OFDM symbols in the HE-LTF field (see 28.3.10.10 (HE-LTF)) |
| *NHE-SIG-B* | The number of OFDM symbols in the HE-SIG-B field (see 28.3.10.8 HE-SIB-B). (#4989) |
| *Kr* | Set of usedsubcarrier indices in the *r*-th RU (#4985) |
| *R, Ru* | *Ru* is the coding rate for user *u*, *u* = 0, ..., *Nuser,total* – 1.For an HE SU PPDU, *R = R0*For an HE MU PPDU, *R* is undefined |
| *Mr,u* | The summed number of space-time streams of users priori to user u in RU r. (#4987) For pre-HE modulated fields, *Mr,u* = 0. For HE modulated fields, *Mr,0* = 0 for *u* = 0 and  for (#4986) *u* = 1, ..., *Nuser,r* – 1. |
| NOTE—For pre-HE modulated fields, *u* and *r* are zeros only since *Nuser,r* = 1 and *NRU* = 1. |

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| **CID** | **Clause** | **P** | **L** | **Comment** | **Proposed Change** | **Resolution** |
| 7500 | 28.5 | 372 | 57 | "non-OFDMA 160MHz and 80+80MHz" should be changed to "2\*996-tone RU and non-OFDMA 160MHz and 80+80MHz". | As per comment | Accepted.TGax editor: please make the changes shown in 11-17/0316r0 for CID7500 |
| 7501 | 28.5 | 372 | 63 | DCM stands for dual carrier modulation, not dual subcarrier modulation. | Change "Dual sub-carrier modulation (DCM)" to "Dual carrier modulation (DCM)" | Accepted TGax editor: please make the changes shown in 11-17/0316r0 for CID7501 |
| 9321 | 28.5 | 373 | 4 | There is no subfield named Tx or Rx Highest Supported Long GI Data Rate. | Update the subfield name "Tx or Rx Highest Supported Long GI Data Rate" which appears in line 4 and line 6 in page 373. | RevisedCorrected the subfield name. TGax editor: please make the changes shown in 11-17/0316r0 for CID9321 |
| 10234 | 28.5 | 373 | 23 | It makes no sense to state "mandatory" or "optional" in the title of each MCS table. Mandatory/optional features are defined in normative text and summalized in PICS (Annex B). There are many tables that includ both mandatory and optional MCS indices. For example, in table 28-48 (HE-MCSs for mandatory 26-tone RU, NSS = 2), all of MCS indices are defined as optional for non-AP STAs. | Delete "mandatory" and "optional" in the caption of the table 28-47 to 28-102. | Accepted. TGax editor: please make the changes shown in 11-17/0316r0 for CID10234 |
| 7244 | 28.5 | 375 | 9 | The N\_DBPS value for MCS0 should be N\_CBPS x R = 96 x (1/2) = 48. | Change the N\_DBPS value "24" to "48" in Tables 28-50. | Accepted. TGax editor: please make the changes shown in 11-17/0316r0 for CID7244 |
| 7245 | 28.5 | 382 | 55 | The N\_DBPS value for MCS6 should be N\_CBPS x R = 1836 x (3/4) = 1377. | Change the N\_DBPS value "1337" to "1377" in Tables 28-65. | Accepted. TGax editor: please make the changes shown in 11-17/0316r0 for CID7245 |
| 7246 | 28.5 | 382 | 61 | The N\_DBPS value for MCS9 should be N\_CBPS x R = 2448 x (5/6) = 2040. | Change the N\_DBPS value "2048" to "2040" in Tables 28-65. | Accepted. TGax editor: please make the changes shown in 11-17/0316r0 for CID7246  |
| 7502 | 28.5 | 401 | 4 | In the title of Table 28-95, "HE-MCSs for optional non-OFDMA 160 MHz and 80+80 MHz" should be changed to "HE-MCSs for optional 2\*996-tone RU and optional non-OFDMA 160MHz and 80+80MHz". Do the same thing for the title of Table 28-96 to Table 28-102. | As per comment | Accepted. TGax editor: please make the changes shown in 11-17/0316r0 for CID7502 |

***To TGax editor: Please make the following changes to 28.5 (#CID7500, 7501,9321 )***

The rate-dependent parameters for 26-tone RU, 52-tone RU, 106-tone RU, 242-tone RU and non-OFDMA 20 MHz, 484-tone RU and non-OFDMA 40 MHz, 996-tone RU and non-OFDMA 80 MHz, 2\*996-tone RU and (#7500) non-OFDMA 160 MHz and 80+80 MHz *NSS* = 1, …, 8 are given in Table 28-47 (HE-MCSs for mandatory 26-tone RU, NSS = 1) through Table 28-102 (HE-MCSs for optional non-OFDMA 160 MHz and 80+80 MHz, NSS = 8). Support for HE-MCS 8, 9, 10, and 11 (when valid) is optional in all cases. HE-MCS 10 and 11 (1024-QAM) are applicable only to RU sizes equal to or larger than 242 tones.

Dual (#7501) carrier modulation (DCM) is an optional modulation scheme for any OFDMA and non OFDMA transmissions. DCM is only applied to MCS 0, MCS 1, MCS 3 and MCS 4. DCM is applied only with *NSS* = 1 or *NSS* = 2 (in the case of single user RU in an HE MU PPDU, *NSS,r,u* = 1 or *NSS,r,u* = 2). An HE STA shall support single spatial stream HE-MCSs within the range HE-MCS 0 to HE-MCS 7 for all channel widths for which it has indicated support regardless of the Tx or Rx Highest MCS Supported subfield values in the Supported HE-MCS and NSS Set field. When more than one spatial stream is supported, the Tx or Rx Highest MCS Supported (#9321) subfield values in the Supported HE-MCS and NSS Set field may result in a reduced HE-MCS range (cut-off) for *NSS* = 2, …, 8. Support for OFDMA 26-tone RU, 52-tone RU, 106-tone RU, 242-tone RU and 996-tone RU with *NSS* = 1 is mandatory. Support for non-OFDMA 20 MHz, 40 MHz, and 80 MHz with *NSS*= 1 is mandatory. Support for more than one spatial stream is optional in all cases. Support for OFDMA and non-OFDMA 160 MHz and 80+80 MHz with *NSS* = 1, …, 8 is optional.

***To TGax editor: Please make the following changes to 28.5 (#CID10234, 7502, 7244, 7245, 7246 )***

***Remove the word “mandatory” or “optional” from the title of Table 28-47 to 28-102 (#10234)***

***Replace the “non-OFDMA 160 MHz and 80+80 MHz” by “2\*996-tone RU and non-OFDMA 160 MHz and 80+80 MHz” in the title of Table 28-95 to 28-102 (#7502)***

***Change the N\_DBPS value of MCS0 from 24 to 48 in Table 28-50—HE-MCSs for mandatory 26-tone RU, NSS = 4 (#7244)***

***Change the N\_DBPS value of MCS6 from 1337 to 1377 (#7245) and N\_DBPS value of MCS9 from 2048 to 2040 (#7246) in Table 28-65—HE-MCSs for mandatory 106-tone RU, NSS = 3***