IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Miscellaneous PHY CIDs | | | | | | Date: 2024-3-11 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Youhan Kim | Qualcomm Technologies, Inc. |  |  | [youhank@qti.qualcomm.com](mailto:youhank@qti.qualcomm.com) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

This submission proposes resolutions to the following comments from CC50 on P802.11bn D0.1:

1653, 3371, 1661, 1662, 1630

NOTE – Set the Track Changes Viewing Option in the MS Word to “All Markup” to clearly see the proposed text edits.

**Revision History:**

R0: Initial version.

R1: Added CID 1630

# CID 1653, 3371

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| **CID**  **Clause**  **Page.Line** | **Comment** | **Proposed Change** |
| 1653  38.3.18  204.27 | Define Non-HT duplicate transmission, or refer to 11be | as in comment |
| 3371  38.3.18  204.27 | There is no new BW being introduced in UHR, so there is no need for a section for non-HT duplicate transmission. Just refer to EHT. | Delete the section 38.3.18 Non-HT duplicate transmission |

## Discussion

Background: 11bn D0.2 P214

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UHR does not define any new PPDU bandwidth modes compared to EHT. I.e., both EHT and UHR STAs support the same 20, 40, 80, 160 and 320 MHz PPDU bandwidth modes. Therefore, there is no need for Clause 38 to write down new equations for Non-HT duplicate transmissions. Rather, it is sufficient to refer back to existing equations in prior PHY clauses.

## Proposed Resolution: CID 1653, 3371

**REVISED**

**Instruction to TGbn Editor:**

Implement the proposed text updates for CIDs 1653 and 3371 in <https://mentor.ieee.org/802.11/dcn/25/11-25-0644-01-00bn-misc-phy-cids.docx>

**Note to TGbn Editor:**

CIDs 1653 and 3371 have the same proposed text updates.

**Note to commenter:**

The proposed text defines Non-HT duplicate transmission for UHR.

## Proposed Text Updates: CID 1653, 3371

*Instruction to TGbn Editor: Update 11bn D0.2 P214L28 as shown below:*

**38.3.18 Non-HT duplicate transmission**

If the TXVECTOR parameter FORMAT is NON\_HT and the TXVECTOR parameter NON\_HT\_MODULATION is NON\_HT\_DUP\_OFDM, the transmitted PPDU is a non-HT duplicate PPDU. Non-HT duplicate transmission is used to transmit to non-HT STAs, HT STAs, VHT STAs, HE STAs, EHT STAs and UHR STAs that may be present in a part of a 40 MHz, 80 MHz, 160 MHz, or 320 MHz channel (see Table 38-2). The RL-SIG, U-SIG, UHR-SIG, UHR-STF, UHR-LTF, and PE fields are not transmitted.

The L-STF and L-LTF fields shall be transmitted in the same way as in the UHR transmission. The L-SIG field shall be transmitted in the same way as in the UHR transmission, with the following exceptions:

—The Rate and Length fields shall follow 17.3.4 (SIGNAL field)

—The four additional subcarriers at indices and are not modulated (no energy)

NOTE—For a non-HT duplicate PPDU transmission that is a preamble punctured PPDU, the L-STF, L-LTF, and L-SIG fields are not transmitted in each punctured 20 MHz subchannel.

In a 40 MHz non-HT duplicate transmission, the Data field shall be as defined by Equation (19-61).

In an 80 MHz or 160 MHz non-HT duplicate transmission, the Data field shall be as defined by Equation (27-123).

In a 320 MHz non-HT duplicate transmission, the Data field shall be as defined by Equation (36-98).

# CID 1661

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| **CID**  **Clause**  **Page.Line** | **Comment** | **Proposed Change** |
| 1661  38.3.27  215.3 | Define channel numbering, or refer to 11be | as in comment |

## Discussion

Background: 11bn D0.2 P225

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There are no new channel bandwidth or channels (i.e. channel numbers) being added specifically for UHR. Hence, it is sufficient for the channel numbering in Clause 38 (UHR) to simply refer back to EHT.

FYI, following is the EHT text on channel numbering.

11be D7.0 P947:

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## Proposed Resolution: CID 1661

**REVISED**

**Instruction to TGbn Editor:**

Implement the proposed text updates for CID 1661 in <https://mentor.ieee.org/802.11/dcn/25/11-25-0644-01-00bn-misc-phy-cids.docx>

**Note to commenter:**

The proposed text refers readers to Clause 36 (EHT) for channel numbering and channelization.

## Proposed Text Updates: CID 1661

*Instruction to TGbn Editor: Update 11bn D0.2 P225L55 as shown below:*

**38.3.28 Channel numbering and channelization**

Channel numbering and channelization for UHR STAs are the same as those for EHT STAs. See 36.3.24 (Channel numbering and channelization).

# CID 1662

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| **CID**  **Clause**  **Page.Line** | **Comment** | **Proposed Change** |
| 1662  38.3.28  215.6 | Define Regulatory requirements | as in comment |

## Discussion

Background: 11bn D0.2 P225

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While it is not desirable to replicate the same text in the IEEE 802.11 standard in multiple locations in general, regulatory requirements could have severe consequences to products even though it is outside the scope of the IEEE 802.11 standard. Hence, to be ‘on par’ with other PHY clauses, the same text from EHT (36.3.25) is copied to 38.3.29 for now.

## Proposed Resolution: CID 1662

**REVISED**

**Instruction to TGbn Editor:**

Implement the proposed text updates for CID 1662 in <https://mentor.ieee.org/802.11/dcn/25/11-25-0644-01-00bn-misc-phy-cids.docx>

**Note to commenter:**

The proposed text copies the regulatory requirements from Clause 36 (EHT).

## Proposed Text Updates: CID 1662

*Instruction to TGbn Editor: Update 11bn D0.2 P225L60 as shown below:*

**38.3.29 Regulatory requirements**

WLANs implemented in accordance with this standard are subject to equipment certification and operating requirements established by regional and national regulatory administrations. The PHY specification establishes minimum technical requirements for interoperability, based upon established regulations at the time this standard was issued. These regulations are subject to change. Requirements that are subject to local geographic regulations are annotated within the PHY specification. Regulatory requirements that do not affect interoperability are not addressed in this standard. Implementers are referred to the regulatory sources in Annex D for further information. Operation in countries within defined regulatory domains might be subject to additional or alternative national regulations.

# CID 1630

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| **CID**  **Clause**  **Page.Line** | **Comment** | **Proposed Change** |
| 1630  38.3.15.1  139.17 | Define Figure 38-xx (Timing boundaries for UHR PPDU fields) | as in comment |

## Background

11bn D0.2 P148

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| … |

## Proposed Resolution: CID 1630

**REVISED**

**Instruction to TGbn Editor:**

Implement the proposed text updates for CID 1630 in <https://mentor.ieee.org/802.11/dcn/25/11-25-0644-01-00bn-misc-phy-cids.docx>

**Note to commenter:**

The proposed text creates two new figures for the timing boundaries (one for UHR MU/TB PPDU, and another for UHR ELR PPDU), as well as add mathematical description supplementing the figures.

## Proposed Text Updates: CID 1630

*Instruction to TGbn Editor: Update 38.3.13 at 11bn D0.2 P144L7 as shown below:*

**38.3.13 Timing-related parameters**

Table 38-16 defines the timing-related parameters for UHR PPDU format.

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| Table 38-16 – Timing-related constants | | |
| Parameter | Value | Description |
| Δ*F*,Pre-UHR | 312.5 kHz | Subcarrier frequency spacing for the pre-UHR modulated fields |
| Δ*F*,UHR | 78.125 kHz | Subcarrier frequency spacing for the UHR modulated fields |
| *TDFT*,Pre-UHR | 3.2 µs | IDFT/DFT period for the pre-UHR modulated fields |
| *TDFT*,UHR | 12.8 µs | IDFT/DFT period for the UHR modulated fields |
| *TGI*,Pre-UHR | 0.8 µs | Guard interval duration for the pre-UHR modulated fields excluding the L-LTF field |
| *TGI*,L-LTF | 1.6 µs | Guard interval duration for the L-LTF field |
| *TGI*,ELR-MARK | 0.8 µs | Guard interval duration for the ELR-MARK field |
| *TGI1*,Data | 0.8 µs | Base guard interval duration for the Data field |
| *TGI2*,Data | 1.6 µs | Double guard interval duration for the Data field |
| *TGI4*,Data | 3.2 µs | Quadruple guard interval duration for the Data field |
| *TGI*,Data | *TGI1*,Data, *TGI2*,Data or *TGI4*,Data depending on the GI used for the Data field | Guard interval duration for the Data field |
| *TGI*,UHR-LTF | *TGI*,Data | Guard interval duration for the UHR-LTF field, same as *TGI*,Data |
| *TGI*,UHR-LTF,ELR | 1.6 µs | Guard interval duration for the UHR-LTF field in UHR ELR PPDU |
| *TGI*,UHR-LTF,ELR | 1.6 µs | Guard interval duration for the UHR-LTF field in UHR ELR PPDU |
| *TGI*, ELR-SIG | 1.6 µs | Guard interval duration for the ELR-SIG field |
| *TGI*,Data,ELR | 1.6 µs | Guard interval duration for the Data field in UHR ELR PPDU |
| *T*UHR-LTF,ELR | 6.4 µs | Duration of each UHR-LTF OFDM symbol without GI in UHR ELR PPDU |
| *TSYM*, ELR-MARK | 4 µs = *TDFT*,Pre-UHR + *TGI*,ELR-MARK | OFDM symbol duration for ELR-MARK field |
| *TSYM*, UHR-LTF,ELR | 8 µs = *T*UHR-LTF,ELR+ *TGI*,UHR-LTF,ELR | OFDM symbol duration for UHR-LTF field including GI in UHR ELR PPDU |
| *TSYM*, ELR-SIG | 14.4 µs = *TDFT*,UHR+ *TGI*,Data,ELR *=*  1.125 ´ *TDFT*,UHR | OFDM symbol duration for ELR-SIG field including GI |
| *TSYM*, Data,ELR | 14.4 µs = *TDFT*,UHR+ *TGI*,Data,ELR *=*  1.125 ´ *TDFT*,UHR | OFDM symbol duration for ELR-Data field including GI in UHR ELR PPDU |
| *T*L-STF | 8 µs = 10 ´ *TDFT*,Pre-UHR / 4 | Non-HT Short Training field duration |
| *T*L-LTF | 8 µs = 2 ´ *TDFT*,Pre-UHR + *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*U-SIG | 8 µs = 2 ´ 4 µs | U-SIG field duration in an UHR PPDU |
| *T*UHR-SIG | 4 µs = *TDFT*,Pre-UHR + *TGI*,Pre-UHR | Duration of each OFDM symbol in the UHR-SIG field |
| *T*ELR-MARK | 8 µs = 2 ´ *TSYM*, ELR-MARK | ELR-MARK field duration |
| *T*UHR-STF-T | 8 µs = 5 × 1.6 µs | UHR-STF field duration for an UHR TB PPDU |
| *T*UHR-STF-NT | 4 µs = 5 × 0.8 µs | UHR-STF field duration for an UHR MU PPDU and an UHR ELR PPDU |
|  |  |  |
| *T*UHR-LTF-1X | 3.2 µs | Duration of each 1´ UHR-LTF OFDM symbol without GI |
| *T*UHR-LTF-2X | 6.4 µs | Duration of each 2´ UHR-LTF OFDM symbol without GI |
| *T*UHR-LTF-4X | 12.8 µs | Duration of each 4´ UHR-LTF OFDM symbol without GI |
| *T*UHR-LTF | *T*UHR-LTF-1X, *T*UHR-LTF-2X or *T*UHR-LTF-4X depending upon the UHR-LTF duration used | Duration of each OFDM symbol without GI in the UHR-LTF field |
| *T*UHR-LTF-SYM | *T*UHR-LTF + *T*GI,UHR-LTF | Duration of each OFDM symbol including GI in the UHR-LTF field |
| *T*UHR-LTF, ELR | 16 µs = *TSYM*, UHR-LTF,ELR ´ 2 | ELR-LTF field duration in UHR ELR PPDU |
| *T*ELR-SIG | 28.8 µs= *TSYM*, ELR-SIG ´ 2 | ELR-SIG field duration |
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| Table 38-18 – Frequently used parameters | |
| Symbol | Explanation |
| *NRU* | For pre-UHR modulated fields, *NRU* = 1*.*  For UHR modulated fields, *NRU* represents the number of occupied RU(s) or MRU(s) in the transmission. |
| *Nuser,r* | For pre-UHR modulated fields, *Nuser* = 1.  For UHR modulated fields, *Nuser,r* represents the total number of users in the *r*-th occupied RU or MRU of the transmission. |
| *Nuser,total* | Total number of users in all occupied RU(s) or MRU(s) of a UHR transmission, i.e.,  . |
| *NCPBS,u* | Number of coded bits per OFDM symbol for user *u*, *u* = 0, 1, … , *Nuser,total* ˗ 1. |
| *NCPBS,m,u* | Number of coded bits per OFDM symbol over the *m*-th spatial stream for user *u*, *m* = 1, 2, … , *Nss,r,u* in OFDMA transmission, *u* = 0, 1, … , *Nuser,total* ˗ 1. |
| *NSD* | Effective number of data tones carrying unique data.  NOTE—The *NSD* value with DCM (when applicable) is half of the *NSD* value without DCM, for each RU or MRU size. |
| *NSD,u* | Effective number of data tones carrying unique data for user *u*, *u* = 0, 1, … , *Nuser,total* ˗ 1. |
| *NCBPSS,u* | Number of coded bits per OFDM symbol per spatial stream for user *u*,  *u* = 0, 1, … , *Nuser,total* ˗ 1. |
| *NCBPSS,l,u* | Number of coded bits per OFDM symbol per spatial stream for user *u* in the *l*-th 80 MHz frequency block, *u* = 0, 1, … , *Nuser,total* ˗ 1 and *l* = 0, 1, … , *L* ˗ 1. *L* is the number of 80 MHz frequency subblocks. |
| *NDBPS,u* | Number of data bits per OFDM symbol for user *u*, *u* = 0, 1, … , *Nuser,total* ˗ 1.  NOTE—For LDPC, *NDBPS,u* is derived from *NDBPS,u* using *Ru*, rather than the effective LDPC code rate, which may vary depending on shortening/puncturing/repetition performed during LDPC encoding. |
| *NBPSCS,u* | Number of coded bits per subcarrier per spatial stream for user *u*,  *u* = 0, 1, … , *Nuser,total* ˗ 1. |
| *NBPSCS,m,u* | Number of coded bits per subcarrier over the *m*-th spatial stream for user *u*, *m* = 1, 2, … , *Nss,r,u* in OFDMA transmission, *u* = 0, 1, … , *Nuser,total* ˗ 1. |
| *NBPSCS,l,u* | Number of coded bits per subcarrier per spatial stream for user *u* in the *l*-th 80 MHz frequency block, *u* = 0, 1, … , *Nuser,total* ˗ 1 and *l* = 0, 1, … , *L* ˗ 1. *L* is the number of 80 MHz frequency subblocks. |
| *NRX* | Number of receive chains. |
| *NSS,r,u*, *NSS,u*, *NSS* | Number of spatial streams. For the Data field, *NSS,r,u* is the number of spatial streams at *r*-th RU or MRU for user *u*, *u* = 0, 1, … , *Nuser,total* ˗ 1, and *NSS,u* is the number of spatial streams for user *u*, *u* = 0, 1, … , *Nuser,total* ˗ 1.  For the Data field of a UHR PPDU, . |
| *NUHR-LTF* | The number of OFDM symbols in the UHR-LTF field (see 38.3.15.11) |
| *NUHR-SIG* | The number of OFDM symbols in the UHR-SIG field (see 38.3.15.9) |

*Instruction to TGbn Editor: Update 11bn D0.2 P146L54 as shown below:*

**38.3.14.3 Channel frequencies**

Frequencies *f*CH,start, *f*c,idx0, *f*P20,idx, *f*P40,idx, *f*P80,idx, and *f*P160,idx are as described in 36.3.11.3(Channel frequencies) except with dot11EHTCurrentChannelWidth and dot11EHTCurrentChannelCenterFrequencyIndex0 replaced with dot11UHRCurrentChannelWidth and dot11UHRCurrentChannelCenterFrequencyIndex0, respectively.

**38.3.14.4 Transmitted signal**

The transmitted signal is described in complex baseband signal notation. The actual transmitted signal on transmit chain is related to the complex baseband signal by the relation shown in Equation (38-X1).

 (38-X1)

where

 represents the complex baseband signal of transmit chain *iTX*.

*fc* represents the center frequency of the transmitted PPDU. Table 36-25 (Center frequency of the transmitted PPDU) shows *fc* as a function of the channel starting frequency, channel width and CH\_BANDWIDTH, where dot11EHTCurrentChannelWidth is replaced with dot11UHRCurrentChannelWidth, and *f*CH,start, *f*c,idx0, *f*P20,idx, *f*P40,idx, *f*P80,idx, and *f*P160,idx are described in 38.3.14.3.

The transmitted RF signal is derived by upconverting the complex baseband signal, which consists of several fields. The timing boundaries for the various fields are shown in Figure 38-X1 for UHR MU PPDU and UHR TB PPDU, and Figure 38-X2 for UHR ELR PPDU where *NUHR-LTF* is the number of UHR-LTF symbols and is defined in Table 36-23 (Frequently used parameters), *NUHR-SIG* is the number of OFDM symbols in the UHR-SIG field present in an UHR MU PPDU, and *NSYM* is the number of OFDM symbols in the Data field.



Figure 38-X1 – Timing boundaries for UHR MU PPDU and UHR TB PPDU fields





Figure 38-X2 – Timing boundaries for UHR ELR PPDU fields



The time offset, *tField*, determines the starting time of the corresponding field relative to the start of L-STF (*t* = 0).

The complex baseband signal transmitted on transmit chain *iTX* shall be as shown in Equation (36-X2).

 (38-X2)

where

 is only applicable to an UHR MU PPDU

 is only applicable to an UHR ELR PPDU

 is only applicable to an UHR ELR PPDU























In a UHR MU PPDU and UHR ELR PPDU, for each field excluding the PE field, is defined as the summation of one or more subfields. Each subfield, , is defined to be an inverse Fourier transform in Equation (38-2).

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*Instruction to TGbn Editor: Update 38.3.15 at 11bn D0.2 P148L16 as shown below:*

**38.3.15 UHR preamble**

**38.3.15.1 Introduction**

**…**

The pre-UHR modulated fields (see Figure 38-X1 and Figure 38-X2) are not transmitted in 20 MHz subchannels in which the preamble is punctured.

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