### IEEE P802.11 Wireless LANs

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| PHY Comment resolution for Clause 31 | | | | |
| Date: 2019-03-10 | | | | |
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Abstract

This submission proposes resolutions for comments of TGba Draft D2.0 with the following CIDs: 2019, 2063, 2064, 2065, 2066, 2069, 2070, 2074, 2075, 2076, 2077, 2078, 2079, 2085, 2104, 2497, 2500, 2618, 2619, 2669, 2754, 2777, 2789, 2790, 2825, 2826

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 2019 | 99.4445 | 31.2.8 | The text states for WUR PPDU with LDR the Xsym is "different" for WUR-Sync and the WUR-Data field. The following 2 sentences state the WUR PPDU with LDR use the same symbol for the entire WUR-Sync field and WUR-Data field. | Fix the ambiguity and update text and/or equation. | Revised.  We now clarify that Xsym is different for WUR-Sync On symbol and WUR-Data MC-OOK On symbol, but same Xsym is used for all WUR-Sync On symbols and same Xsym is used for all WUR-Data MC-OOK On symbols. |
| 2063 | 89.10 | 31.2.4 | Although the actual waveform generation of WUR-sync and WUR-Data fields is implementation dependent, meeting the requirements in WUR transmits specification should be emphasized. | Change "The actual waveform generation of theses fields is implementation dependent." to "The actual waveform generation of these fields is implementation dependent and shall meet all requirements in 31.2.12 WUR transmit specification." | Accept. |
| 2064 | 89.35 | 31.2.4 | Delete "An example of a WUR signal generator for the WUR-Sync field is shown in 31-4 An Example of a WUR signal generator for the WUR-Sync field." since it has been mentioned from line 5 to line 11 in that page. | See comment. | Revised.  The repetition is removed and now the paragraph reads as “In Figure 31-4 An Example of a WUR signal generator for the WUR-Sync field, the Sync bit sequence is used to……” |
| 2065 | 90.44 | 31.2.4.1 | Simplify the sentences from line 44 to line 47 | Change these lines to " The subcarriers with subcarrier indices k = (-6, -4, -2, 2, 4, 6) are used with non-zero input. Other subcarriers are null. | Accept. |
| 2066 | 92.38 | 31.2.4.4 | "Per-antenna" should be "per-transmit chain" | See comment. Several places in the spec draft have "per-antenna". They may need to be fixed. | Revised.  “per-antenna” to be replaced with “per-transmit chain” throughout the document. |
| 2069 | 98.21 | 31.2.8 | "The integer m is described in" - m takes on the values +1,-1, defining it as integer is confusing | replace with "m takes the values,+1,-1 as described in" | Revised.  The corresponding sentence now reads as “m\_Sym takes values +1 and -1, as described in…” |
| 2070 | 99.22 | 31.2.8 | Missing a formula construction $r\_data(t)$ from $r\_sym(t)$, especially missign the modulating symbol. | Add a line "r\_data (t)=Γêæ\_(n=0)^NΓûÆπÇûd(n) r\_sym (t-nT\_sym)πÇù" where d is the n'th data symbol" or something similary (may be different for the two rates | Reject.  The mapping of WUR-Data to MC-OOK symbols is already provided in 31.2.10.2 |
| 2074 | 88.64 | 31.2.4 | An OOK signal could be generated by hardware 0-1 switcher or any software method, e.g. specifical sequence to simulate On waveform and Off waveform, if the signal can meet the waveform criteria. Therefore it's not necessary to limit the spec to any implementation method in specific favor | replace with "The WUR-Sync field generation may use an On waveform generator (On-WG) and an Off waveform generator (Off-WG)." And modify relative description to make it an exmaple of a possible implementation. | Revised.  The corresponding sentence has been modified as: “The WUR-Sync field generation may use an On waveform generator (On-WG) and an Off waveform generator (Off-WG).” |
| 2075 | 89.1 | 31.2.4 | An OOK signal could be generated by hardware 0-1 switcher or any software method, e.g. specifical sequence to simulate On waveform and Off waveform, if the signal can meet the waveform criteria. Therefore it's not necessary to limit the spec to any implementation method in specific favor | replace with "The WUR-Sync field generation may use an On waveform generator (On-WG) and an Off waveform generator (Off-WG)." And modify relative description to make it an exmaple of a possible implementation. | Revised.  The corresponding sentence has been modified as: “The WUR-Data field generation may use an On waveform generator (On-WG), an Off waveform generator (Off-WG), and WUR-based encoder.” |
| 2076 | 90.40 | 31.2.4.1 | It's strange to describe how a signal is constructed in a block diagram section. And "2us MC-OOK" is not defined anywhere before. | Move this paragraph to sub-clause 31.2.5 Overview of the PPDU encoding. Or add a new sub-clause to explain MC-OOK | Revised.  Replace “2us MC-OOK” with “2us duration MC-OOK” throughout the draft and add the following MC-OOK definition in sub-clause 31.1 Introduction: “For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by Multicarrier On-Off Keying (MC-OOK), which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.” |
| 2077 | 90.64 | 31.2.4.1 | It's strange to describe how a signal is constructed in a block diagram section. And "2us MC-OOK" is not defined anywhere before. | Move this paragraph to sub-clause 31.2.5 Overview of the PPDU encoding. Or add a new sub-clause to explain MC-OOK | Revised.  Replace “2us MC-OOK” with “2us duration MC-OOK” throughout the draft and add the following MC-OOK definition in sub-clause 31.1 Introduction: “For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by Multicarrier On-Off Keying (MC-OOK), which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.” |
| 2078 | 91.25 | 31.2.4.2 | It's strange to describe how a signal is constructed in a block diagram section. And "4us MC-OOK" is not defined anywhere before. | Move this paragraph to sub-clause 31.2.5 Overview of the PPDU encoding. Or add a new sub-clause to explain MC-OOK | Revised.  Replace “4us MC-OOK” with “4us duration MC-OOK” throughout the draft and add the following MC-OOK definition in sub-clause 31.1 Introduction: “For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by Multicarrier On-Off Keying (MC-OOK), which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.” |
| 2079 | 91.43 | 31.2.4.2 | It's strange to describe how a signal is constructed in a block diagram section. And "4us MC-OOK" is not defined anywhere before. | Move this paragraph to sub-clause 31.2.5 Overview of the PPDU encoding. Or add a new sub-clause to explain MC-OOK | Revised.  Replace “4us MC-OOK” with “4us duration MC-OOK” throughout the draft and add the following MC-OOK definition in sub-clause 31.1 Introduction: “For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by Multicarrier On-Off Keying (MC-OOK), which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.” |
| 2085 | 86.51 | 31.2.1 | Since 'BPSK-Mark' field is actually the repeat of L-SIG and it's identified by 11ax devices as 'RL-SIG' field, it's better to change 'BPSK-Mark' to 'RL-SIG'. | Change 'BPSK-Mark' to 'RL-SIG' in the whole standard | Reject.  While the content is the same for both BPSK-Mark and RL-SIG, the physical waveform is different for RL-SIG and BPSK-Mark. RL-SIG uses 4 additional tones (56 tones) when compared to BPSK-Mark (52 tones). Although BPSK-Mark is same as L-SIG, renaming it to RL-SIG will create ambiguity with RL-SIG used in HE PHY (802.11ax). |
| 2104 | 98.62 | 31.2.8 | It is not clear what a multicarrier signal (i.e., MC-OOK) On symbol is. There is no clear definition. In my proposed change, I give one suggestion on how to fix it (the easiest one). But there are many alternatives. | Change the current paragraph, which reads "For the WUR-Sync ON symbols and WUR-Data MC-OOK ON symbols (SymLDROn and SymHDROn), the baseband signal can be obtained by taking the Inverse Discrete Fourier Transform (IDFT) as described below." change it to "For the WUR-Sync ON symbols and WUR-Data MC-OOK ON symbols (SymLDROn and SymHDROn), the baseband multicarrier signal is described by Equation 31-3." | Accept. |
| 2497 | 92.65 | 31.2.4.4 | The sentence "A cyclic shift, corresponding to that value, is then applied to the waveform." is the only sentence in the paragraph. It is not clear what "that value" and "the waveform" are. | Specify "that value" and "the waveform" in the sentence. | Revised.  The corresponding sentence has been modified as “The cyclic shift value, obtained from the lookup table, is applied to the input waveform.” |
| 2500 | 90.16 | 31.2.4.1 | The Sync sequences are predefined. There is no need to use "Generation" in the diagram. | Change "Sequence Generation" box to Text "Sync Sequence". | Revised.  The block diagram in Figure 31-6 is applicable for WUR-Sync and WUR-Data fields. Added a sentence to clarify that for the WUR-Data field, Sequence generation is required to generate WUR encoded bits. |
| 2618 | 98.57 | 31.2.8 | "For the legacy preamble fields (L-STF, L-LTF and L-SIG), the baseband signal is constructed as described in 21.3.7.4 (Transmitted signal). For the BPSK-Mark field, the baseband signal is constructed as described in 31.2.9.2 Non-WUR portion of WUR PHY preamble." The construction of all 20MHz preamble fields have new sections. Need to update accordingly. | Change to "For the legacy preamble fields (L-STF, L-LTF and L-SIG), and BPSK-Mark field, the baseband signal is constructed as described in 31.2.9.2 Non-WUR portion of WUR PHY preamble. | Accept. |
| 2619 | 99.21 | 31.2.8 | "The integer m is described in 31.2.4.4 Symbol Randomizer and Per-antenna Cyclic Shift.", m should have sub index of symbol. | Change "m" to "m\_Sym" in both the equeation and description. | Revised.  The equation has been updated, to capture the symbol index. |
| 2669 | 95.8 | 31.2.5.5 | Multiple frequency segments not supported. Replace "Apply CSD for each transmit chain and frequency segment" with "Apply CSD for each transmit chain" | As shown in the comment | Accept. |
| 2754 | 99.21 | 31.2.8 | "The integer m is described in 31.2.4.4 Symbol Randomizer and Per-antenna Cyclic Shift.", m should have sub index of symbol. | Change "m" to "m\_Sym" in both the equeation and description. | Revised.  The equation has been updated, to capture the symbol index. |
| 2777 | 127.9 | AB | Regarding CID 1155, The resolution is "REJECTED (MAC: 2018-11-17 13:41:59Z) - The group has agreed to provide 3 examples for each data rate." Please provide more appropriate reason why the group decided to have 3 examples. | As in comment. | Reject.  The three examples are optimized for different metrics (For e.x. PAPR and PER performance in different channel conditions) and it is already explained in Annex AB. |
| 2789 | 90.44 | 31.2.4.1 | P90L44 says subcarriers -5, -3, -1, 0, 1, 3, 5 are used. Then, P90L47 says these subcarriers are null. Similar comment onP91L28 and P91L31. | At P90L44, change "Thirteen subcarriers with subcarrier indices k=(-6, -5, ..., -1, 0, 1, 2, ..., 6) are used." to "Six subcarriers with subcarrier indices k=(-6, -4, -2, 2, 4, 6) are used." And delete P90L47. Similar change to P91L38 and P91L31. | Revised.  The related text has been updated. |
| 2790 | 90.58 | 31.2.4.1 | If the receiver is going to primarily measure power level, and not perform FFT on the receive waveform, what is the point of having a cyclic prefix? | Please clarify why a cyclic prefix is needed. | Reject.  Requesting for clarification is not a valid comment.  This implementation enables AP to reuse existing hardware for WUR packet generation. |
| 2825 | 98.10 | 31.2.8 | The term Data Symbol isn't clearly defined in this draft. Is one data symbol in Figure 31-10 equal to one MC-OOK symbol or equal to 2 or 4 MC-OOK symbols? There are only 3 instances of data symbol in this draft. Maybe we should avoid using the term data symbol to avoid the confusion with the traditional definition of a data symbol (which is an OFDM symbol). | Change all "Data Symbol" in Figure 31-10 to "MC-OOK Symbol". Change "the data symbol" in P66L2 to "the first MC-OOK symbol". And change the first sentence on P113L50 to read "The PHY entity shall begin receiving the MC-OOK symbols in the WUR-Data field." | Revised.  Data symbol is replaced with MC-OOK symbol. |
| 2826 | 111.32 | 31.2.14 | The "TX Data" block shouldn't be in Figure 31-13, because "TX Data" block in the legacy PHY profiles is used for transmitting the 16-bit service field, but we don't have the 16-bit service field in a WUR PPDU. | Remove the "TX Data" block from Figure 31-13. | Revised.  TX Data block has been removed as suggested. |

***TGba editor: Replace*** ***with*** ***in Equation (31-3) (#2754, 2619)***

***TGba editor: Change the following paragraphs in 31.2.8 Mathematical description of signals: (Track change on) (#2069, 2104, 2618, 2019)***

…………………………………….(several lines of text)…………………………………………..

For the legacy preamble fields (L-STF, L-LTF and L-SIG), and BPSK-Mark field, the baseband signal is constructed as described in 31.2.9.2 Non-WUR portion of WUR PHY preamble. (#2618)

For the WUR-Sync ON symbols and WUR-Data MC-OOK ON symbols (SymLDROn and SymHDROn), the baseband multicarrier signal is described by Equation 31-3. (#2104)

*r*

*S*

*y*

*m*

*i*

*T*

*X*





*t*





2

*N*

*S*

*y*

*m*

*T*

*o*

*n*

*e*

*N*

*T*

*X*

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*m*

*X*

*s*

*y*

*m*

*k*





*j*

2



*k*



*F*

WUR



*t*

*T*

*G*

*I*

*S*

*y*

*m*



–

*T*

*C*

*S*

*S*

*y*

*m*



*i*

*T*

*X*

–

*T*

*C*

*S*

*R*

*S*

*y*

*m*



*n*

–









exp

*k*

6

–

=

6



=

where

 is the scaling factor to compensate for 50% duty cycle from On-Off Keying.(#1057)

 is the number of transmit chains as defined in Table 31-4 Frequently used parameters.

 is a windowing function used to control spectral leakage. Refer to 17.3.2.5 (Mathematical conventions in the signal descriptions) for a discussion of windowing functions.(#1058)

takes values +1 and -1, as described in 31.2.4.4 Symbol Randomizer and Per-antenna Cyclic Shift. (#2069)(#1210)

 is the subcarrier frequency spacing and is given in Table 31-3 Timing-related constants.

 is the length of cyclic prefix. For 4 µs symbol (SymLDROn),  is equal to 0.8 µs, and for 2 µs symbol (SymHDROn and WUR-Sync ON),  is equal to 0.4 µs.

 is the cyclic shift applied to the signal from transmit chain , and example values are given in Annex AB.(#318)

 is the pseudo-random cyclic shift with cyclic shift index *n* described in 31.2.4.4 Symbol Randomizer and Per-antenna Cyclic Shift. Its values are specified in Table 31-5 Values of pseudo-random cyclic shift with cyclic shift index n for the WUR-Sync field and HDR WUR-Data field and Table 31-6 Values of pseudo-random cyclic shift with cyclic shift index n for the LDR WUR-Data field.(#1211)

, are the subcarrier coefficients, and  equals S-6,6(*k*) if  and 0 otherwise. S-6,6 is an implementation dependent sequence. For WUR PPDU with HDR,  is the same for all WUR-Sync On symbols and WUR-Data MC-OOK On symbols. For WUR PPDU with LDR,  for WUR-Sync On symbol is different from  for WUR-Data MC-OOK On symbol, but same  is used for all WUR-Sync On symbols and same  is used for all WUR-Data MC-OOK On symbols. Example sequences are described in Table AB-1 Example Values for the Sequence S-6,6 used for the Construction of the 2 µs MC-OOK On symbol and Table AB-2 Example Values for the Sequence S-6,6 used for the Construction of the 4 µs MC-OOK On symbol.(#2019)

…………………………………….(several lines of text)…………………………………………..

***TGba editor: Change the following paragraphs in 31.2.4 Transmitter block diagram: (Track change on) (#2063, 2064, 2074, 2075)***

…………………………………….(several lines of text)…………………………………………..

The WUR-Sync field generation may use an On waveform generator (On-WG) and an Off waveform generator (Off-WG). (#2074)

The WUR-Data field generation may use an On waveform generator (On-WG), an Off waveform generator (Off-WG), and WUR-based encoder. (#2075)

Figure 31-4 An Example of a WUR signal generator for the WUR-Sync field, Figure 31-5 An Example of a WUR signal generator for the WUR-Data field, and 31.2.4.1 WUR PPDU waveform generation for WUR-Sync field and high data rate WUR-Data field through 31.2.4.4 Symbol Randomizer and Per-antenna Cyclic Shift show an example of transmitter block diagram for the WUR-Sync field and the WUR-Data field. The actual waveform generation of these fields is implementation dependent and shall meet all requirements in 31.2.12 WUR transmit specification. (#2063)The waveform generation for L-STF, L-LTF, and L-SIG fields is described in 21.3.3 (Transmitter block diagram).(#1196)

In Figure 31-4 An Example of a WUR signal generator for the WUR-Sync field, Sync bit sequence is used to switch between the On waveform generator (On-WG) and the Off waveform generator (Off-WG). (#2064)An example of an On-WG and an Off-WG for the WUR-Sync field is given in 31.2.4.1 WUR PPDU waveform generation for WUR-Sync field and high data rate WUR-Data field. The corresponding mathematical description of the On-WG for the WUR-Sync field is described as SymHDROn in 31.2.8 Mathematical description of signals.

…………………………………….(several lines of text)…………………………………………..

***TGba editor: Change the following paragraphs in 31.2.4.1 WUR PPDU waveform generation for WUR-Sync field and high data rate WUR-Data field: (Track change on) (#2065, 2500, 2789)***

…………………………………….(several lines of text)…………………………………………..

For the WUR-Data field, the sequence generation block generates the WUR encoded bits. For the WUR-Sync field, the sequence generation block just outputs the WUR-Sync sequence. (#2500)

For a single 20 MHz WUR channel, the 2 µs MC-OOK On symbol can be constructed by the On-Waveform Generator (On-WG) using a 64-point IDFT, sampling at 20 MHz as follows:

* The subcarriers with subcarrier indices *k* = (-6, -4, -2, 2, 4, 6) are used with non-zero input. Other subcarriers are null. (#1050, #1198, #1199)

(#2065, 2789)…………………………………….(several lines of text)…………………………………………..

***TGba editor: Change the following paragraphs in 31.2.4.2 WUR PPDU waveform generation for low data rate WUR-Data field: (Track change on) (#2789)***

…………………………………….(several lines of text)…………………………………………..

For a single 20 MHz WUR channel the 4 µs MC-OOK On symbol can be constructed by the On-Waveform Generator (On-WG) using a 64-point IDFT, sampling at 20 MHz as follows:

* The subcarriers with subcarrier indices *k* = (-6, -5, … -1, 1, 2, … 6) are used with non-zero input. Other subcarriers are null. (#1051, #1202, #1199)

…………………………………….(several lines of text)…………………………………………..

***TGba editor: Replace “per-antenna” with “per-transmit chain” throughout the draft and replace “Number of Transmit Antennas” with “Number of Transmit Chains” in Tables AB-3 and AB-4 (#2066)***

***TGba editor: Replace “2 μs MC-OOK” with “2 μs duration MC-OOK” and “4 μs MC-OOK” with “4 μs duration MC-OOK”throughout the draft (#2076, 2077, 2078, 2079)***

***TGba editor: Change the following paragraphs in 31.1 Introduction: (Track change on) (#2076, 2077, 2078, 2079, 2104)***

…………………………………….(several lines of text)…………………………………………..

The WUR PHY provides support for 20 MHz and optionally 40 MHz and 80 MHz continuous channel widths depending on the frequency band and capability. For channel widths equal to 80 MHz, the WUR PHY may support subchannel puncturing transmission where one or more of the non-primary WUR 20 MHz channels are zeroed out.

For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by Multicarrier On-Off Keying (MC-OOK), which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.

(#549)

The WUR PHY uses the Multicarrier On-Off Keying (MC-OOK) modulation, and the coefficients of WUR PHY subcarriers may take values from the BPSK, QPSK, 16-QAM, 64-QAM, or 256-QAM constellation symbols.

…………………………………….(several lines of text)…………………………………………..

***TGba editor: Change the following paragraphs in 31.2.4.4 Symbol Randomizer and Per-antenna Cyclic Shift: (Track change on) (#2497)***

…………………………………….(several lines of text)…………………………………………..

The cyclic shift value, obtained from the lookup table, is applied to the input waveform.

Then the per-antenna cyclic shift is applied to the input waveform. Example values of such cyclic shift diversity are provided in Annex AB.

…………………………………….(several lines of text)…………………………………………..

***TGba editor: Change the item (h) in 31.2.5.5 Construction of the BPSK-Mark: (Track change on) (#2669)***

…………………………………….(several lines of text)…………………………………………..

(h) CSD: Apply CSD for each transmit chain as described in 21.3.8.2.1 (Cyclic shift for pre-VHT modulated fields).

…………………………………….(several lines of text)…………………………………………..

***TGba editor: Replace Figure 31-10 Timing boundaries for the WUR PPDU Fields with the figure below (#2825)***



***TGba editor: Change the following paragraphs in 31.2.15 WUR receive procedure: (Track change on) (#2825)***

…………………………………….(several lines of text)…………………………………………..

The PHY entity shall begin receiving the MC-OOK symbols in the WUR-Data field. If signal loss occurs during reception, prior to completion of the PPDU reception, the error condition PHY-RXEND.indication (CarrierLost) shall be reported to the MAC.

…………………………………….(several lines of text)…………………………………………..

***TGba editor: Replace Figure 31-13 PHY transmit state machine with the figure below (#2826)***

