IEEE P802.11
Wireless LANs

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| CR for Mathematical description of signals Part 1 |
| Date: 2018-11-12 |
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Abstract

This contribution proposes comment resolutions for Section 32.2.7 of the TGba Draft D1.0. The CIDs resolved are: 163, 227, 261, 317, 666, 1059, 191, 228, 262, 667,1060, 192, 663, 664, 217, 162, 1057, 1058, 1210, 1211, 193, 158, 263, 1061, 1208, 161, 194, 159, 964, 977, 665, 212

# Comments on clause 32.7.2

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 317 | 32.2.7 | 79.43 | The definition of the values of X\_{sym}(k), -31<=k<=32, are unclear. What does "suggested values" mean? Annex AB doesn't mention "subcarrier coefficients" but "sequence S\_{-6,6}." Are they the same? | "X\_{sym}(k), -31<=k<=32 are the subcarrier coefficients, and X\_{sym}(k) equals to S-6,6(k) if -6<=k<=6 and 0 otherwise. S-6,6(k) is the implementation dependent sequence, and example sequences are described in Annex AB." | **Revised** (Accepted with minor editorial changes)The TGba Editor makes changes as shown in 802.11-18/1914r1. |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 163 | 32.2.7 | 79.43 | X(k) is defined on subcarriers -31 to 32. Usually the numbers are -32 to 31. Anyway in other clauses the sequence is defined with at most -28 to 28. Anyway the sequences in Anex AB are from -6 to 6 | Define the range or K correctly or define X(k) better in terms of sequences defined in the annex | **Revised**The TGba Editor makes the changes proposed for CID 317 |

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| 227 | 32.2.7 | 79.43 | the subcarrier coefficient described in Annex AB is for -6 Γëñk Γëñ6. | change -31ΓëñkΓëñ32 to -6Γëñ kΓëñ 6 in P79L43 | **Revised**The TGba Editor makes the changes proposed for CID 317 |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 261 | 32.2.7 | 79.43 | X\_sym(k) has non-zero coefficients only from -6 to 6 of k. | Change -31ΓëñkΓëñ32 to -6ΓëñkΓëñ6. | **Revised**The TGba Editor makes the changes proposed for CID 317 |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 666 | 32.2.7 | 79.43 | The text reads "-31 <= k <= 32". This is inconsistent with both Equation (32-2) and Annex AB | change to "-6 <= k <= 6". | **Revised**The TGba Editor makes the changes proposed for CID 317 |

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| 1059 | 32.2.7 | 79.43 | Only the center 13 subcarrier coefficients are defined. The index of the subcarrier coefficients should be -6<=k<=6.Change the running index of k from -6 to 6. | As shown in the comment. | **Revised**The TGba Editor makes the changes proposed for CID 317 |

, are the subcarrier coefficients, and equals if and 0 otherwise. is an implementation dependent sequence. Example sequences are described in Table AB-1 and Table AB-2.

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 228 | 32.2.7 | 79.45 | N\_sym^Tone means the used number of sub-carrier. | change the sentence of P79L45 with " N\_Sym\_Tone is a tone scaling factor. And the value of this factor is 12 for LDR and 6 for HDR respectively | **Revised**(Accepted with minor editorial changes)The TGba Editor makes changes as shown in 802.11-18/1914r1. |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 191 | 32.2.7 | 79.04 | In eq 32-2, shouldn't use Nsym\_tone for normalization since the summation only applies to the index from -6 to 6; | as in the comment | **Revised**The TGba Editor makes the changes proposed for CID 228 |

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| 262 | 32.2.7 | 79.45 | N\_Sym^Tone should be the number of used subcarriers. | Corret the definition of N\_Sym^Tone as follows.N\_Sym^Tone = 12 for LDR, 6 for HDR | **Revised**The TGba Editor makes the changes proposed for CID 228 |

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| 667 | 32.2.7 | 79.45 | The sentence reads "N\_Sym^Tone is the FFT size, and it is equal to 64." This usage of N^Tone is inconsistent with the use of N^Tone elsewhere in the 802.11-16 spec, where N^Tone refers to the number of active subcarriers in the OFDM symbol. | Change the sentence to "N\_Sym^Tone is equal to 12." (since 12 is the number of active subcarriers). | **Revised**The TGba Editor makes the changes proposed for CID 228 |

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| 1060 | 32.2.7 | 79.45 | The value of the parameter is 12 for 4 us symbols and is 6 for 2 us symbols.Change the parameter value from "64" to "12 for 4 us symbols and it is 6 for 2 us symbols". | As shown in the comment. | **Revised**The TGba Editor makes the changes proposed for CID 228 |

 is a tone scaling factor. The value of this factor is 12 for LDR and 6 for HDR, respectively.

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 192 | 32.2.7 | 79.26 | T\_GI\_sym should use the TGI\_WUR which is defined in the timing-related constant. | as in the comment | **Reject**T\_GI\_WUR has the value 0.8 us (table 32.3). On the other hand, T\_GI\_sym has the value 0.4 us for HDR.  |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 663 | 32.2.7 | 78.31 | The equation is missing a number. | Add a number to the equation | **Accept**The TGba Editor makes changes as shown in 802.11-18/1914r1.  |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 664 | 32.2.7 | 78.26 | The sentence reads "It can be mathematically described as:" This sentence ought to contain normative text. As described in 11-09/1034 the usage of the verb "can" is non-normative and its use should be considered carefully. If this text is not normative, then the presence of the legacy preamble (L-STF, L-LTF, L-SIG) and the BPSK Mark are optional. This would prevent backwards compatibility with legacy STAs. Section 32.2.7 should be compared to Section 19.3.7 of 802.11-2016, which is also normative, and in which Equation 19-2 is normative. Furthermore, the sentence should refer to the equation number introduced in the previous comment | Change the text to "It shall be as shown in Equation (32-XYZ)" (See also IEEE 802.11-16 page 2535, Equation (21-12) and its description) | **Accept**The TGba Editor makes changes as shown in 802.11-18/1914r1.See also the resolution to CID 663, which proposes to give a number to the equation in P78.L31 |

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| 217 | 32.2.7 | 78.24 | The baseband signal is not properly defined. It says "The baseband signal is constructed by the concatenation of several fields as shown in Figure 32-10 (Timing boundaries for the WUR PPDU Fields). It can be mathematically described as:", but it should be mandatory like this. | The baseband signal shall be constructed by the concatenation of several fields as shown in Figure 32-10 (Timingboundaries for the WUR PPDU Fields) and mathematically described as: | **Revised**The TGba Editor makes the changes proposed for CID 664 |

The baseband signal is constructed by the concatenation of several fields as shown in Figure 32-10 (Timing boundaries for the WUR PPDU Fields). It shall be as shown in Equation (32-XYZ):

(32-XYZ)

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 162 | 32.2.7 | 79.03 | It is not clear how is the modulated bit/sym related to r\_Sym. None of the symbols in the formula are have any direct or indirect relation to modulated bit/sym | Add the modulated bit to the formula, or add that formula to each subclause that describes data transmission or explain the connection between (probably X) to the modulated data | **Reject.** The text in page 78.62-78.65 explains that r\_sym can be either of SymLDROn or SymHDROn, depending on the data rate. Moreover, Tables 32-10, 32-11 explain the relation between the modulated bit and SymLDROn/SymHDROn |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 1057 | 32.2.7 | 79.10 | In Eq. (32-2), it is not clear why sqrt(2) term is present in the numerator.Add the following note below Eq. (32-2):"sqrt(2) is the scaling factor, to compensate for 50% duty cycle from On-Off Keying." | As shown in the comment. | **Accept**The TGba Editor makes changes as shown in 802.11-18/1914r1. |

where

 is the scaling factor, to compensate for 50% duty cycle from On-Off Keying.

 is the number of transmit chains as defined in Table 32-4 (Frequently used parameters).

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 1058 | 32.2.7 | 79.18 | Description of windowing function for 2 us symbol is missing | As shown in the comment. | **Revised**In fact Section 17.3.2.5 gives a general window function, valid not only for a duration parameter T = 4 us but more generally for any duration parameter T.The TGba Editor makes changes as shown in 802.11-18/1914r1. |

 is a windowing function. A suggested windowing function , valid for any duration parameter , is given

in 17.3.2.5 (Mathematical conventions in the signal descriptions).

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 1210 | 32.2.7 | 79.20 | m described in 32.2.3 which is a whole chapter. Need to be specfic by using term with "phase rotation" somewhere-specific in 32.2.3. | as in comment | **Accept**The TGba Editor makes changes as shown in 802.11-18/1914r1. |

The integer *m* is described in32.2.3.4 (Symbol Randomizer).

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 1211 | 32.2.7 | 79.37 | pseudo-random cyclic shift with cyclic shift index n described in 32.2.3 which is a whole chapter. Need to be specfic somewhere-specific in 32.2.3. | as in comment | **Accept**The TGba Editor makes changes as shown in 802.11-18/1914r1. |

is the pseudo-random cyclic shift with cyclic shift index *n* described in 32.2.3.4 (Symbol Randomizer). Its values are specified in Table 32-5 (Values of pseudo-random cyclic shift with cyclic shift index n for the Sync field and HDR Data field) and Table 32-6 (Values of pseudo-random cyclic shift with cyclic shift index n for the LDR Data field).

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 193 | 32.2.7 | 79.31 | T\_CS,Sym: should remove the sym from subscript since CSD is not symbold dependent | as in the comment | **Reject**CSD is symbol dependent, as exemplified in Annex AB. |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 158 | 32.2.7 |  | It may be better to have a mathematical expression for FDMA WUR PPDU signal. | Add an expression | **Reject**The comment fails to identify changes in sufficient detail so that the specific wording of the changes that will satisfy the commenter can be determined. |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 263 | 32.2.7 | 80.46 | The baseband signal equation for the WUR Sync and WUR Data in a FDMA transmission is also needed. | Present the the baseband signal equation for the WUR Sync and WUR Data in a FDMA transmission. | **Reject**The comment fails to identify changes in sufficient detail so that the specific wording of the changes that will satisfy the commenter can be determined. |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 1061 | 32.2.7 | 79.48 | The Eq. (32-2) is provided for single 20 MHz WUR channel. The corresponding equation for FDMA case is missing. | As shown in the comment. | **Reject**The comment fails to identify changes in sufficient detail so that the specific wording of the changes that will satisfy the commenter can be determined. |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 1208 | 32.2.7 | 77.61 | claify what is the WUR signal. Here, it is used to indicate WUR PPDU including legacy preamble. Somewhere in the spec, it is used to indicate only WUR corresponding part (sync and data fields) | as in comment | **Reject**The WUR PPDU in P77L61 is already described in detail in P78L31.  |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 161 | 32.2.7 | 79.03 | It is not clear how r\_data is composed from r\_Sym | Add a formula to explain that issue | **Reject**The comment fails to identify changes in sufficient detail so that the specific wording of the changes that will satisfy the commenter can be determined. |

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| 194 | 32.2.7 | 79.60 | Unlike Table 32-5 and 32-6 which specifies the cyclic shift value for each n, the Table 32-7 seems to give an example of cyclic shift values for the 1st 7 syn symbols. May want to clarify it | as in the comment | **Reject**The comment fails to identify changes in sufficient detail so that the specific wording of the changes that will satisfy the commenter can be determined. |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 159 | 32.2.7 | 80.00 | It is not clear if the values in Table 32-6 and Table 32-7 are optional (i.e., they are examples) or mandatorily required. | Add a statement to clarify | **Reject**Note: there is probably a typo in the comment, it seems to refer to Table 32-5 and Table 32-6 (instead of Table 32-7), since these are the tables in P80. The text in P79L36 reads:“is the pseudo-random cyclic shift with cyclic shift index *n* described in 32.2.3 (Transmitter block diagram). Its values are specified in Table 32-5 (Values of pseudo-random cyclic shift with cyclic shift index n for the Sync field and HDR Data field) and Table 32-6 (Values of pseudo-random cyclic shift with cyclic shift index n for the LDR Data field)”This text states that the tables specify the values of T^n\_CSR,Sym |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 964 | 32.2.7 | 79.28 | "WUR Sync On" should not have spaces | Change "WUR Sync On" to "WURSyncOn" | **Reject**WURSyncOn is not defined in the text.  |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 977 | 32.2.7 | 80.05 | In Tables 32-5 and 32-6 we use negative values for cyclic shifts while in Annex AB we use positive values for cyclic shift values. Maybe we should harmonize on one approach. Also, it is possible the total CS to exceed the symbol duration when we combine both the random CS and the per-antenna CS. That may lead to some confusion. The mathematics is okay in 32-2 due to the nature of the exponential function, but this still may cause confusion. | Consider harmonizing the polarity of the CS values for the random CS and the per-antenna CS to either all positive or all negative values, and possibly add text to avoid confusion of the total CS exceeds the duration of the symbol (not counting the GI) | **Revised**Regarding harmonizing the CS values, update the CS delay values in the Tables AB-3 and AB-4 so that the delays are negativeAs stated in the comment, the mathematics in Equation (32-2) works correctly even if the combined delays exceed the symbol duration  |

Note: Update of the Tables AB-3 and AB-4 should be done in cooperation with the authors

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 665 | 32.2.7 | 78.63 | The text reads: "For the WUR Sync ON symbols and WUR Data MC-OOK ON symbols (SymLDROn and SymHDROn), the baseband signal can be obtained". This text ought to be normative. As described in 11-09/1034 the usage of the verb "can" is non-normative and its use should be considered carefully. If this text is not normative, then the spec would be incomplete. The normative text in Section 32.2.9.2, page 84, line 11, states that "The encoded binary data shall be modulated using MC-OOK", but MC-OOK is undefined in the current version of this draft. | Change the text to: "For the WUR Sync ON symbols and WUR Data MC-OOK ON symbols (SymLDROn and SymHDROn), the baseband signal shall be as specified in Equation (32-2) " | **Accept**The TGba Editor makes changes as shown in 802.11-18/1914r1 |

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| **CID** | **Clause** | **Page/line** | **Comment** | **Proposed change** | **Resolution** |
| 212 | 32.2.7 | 78.62 | It is clear from the document that MC-OOK is the modulation used to generate WUR signals. There are examples of how MC-OOK might be constructed, but the modulation is never properly defined. I think this is a major flaw that needs to be fixed. | Replace the text "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." with "For the WUR Sync ON symbols and WUR Data MC-OOK ON symbols (SymLDROn and SymHDROn),the baseband signal shall be constructed as equation (32-2)." | **Revised**(minor editorial change)The TGba Editor makes the changes proposed for CID 665The TGba Editor makes changes as shown in 802.11-18/1914r1 |

For the WUR Sync ON symbols and WUR Data MC-OOK ON symbols (SymLDROn and SymHDROn), the baseband signal shall be as specified in Equation (32-2).