### IEEE P802.11 Wireless LANs

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| PHY Comment resolution for MC-OOK | | | | |
| Date: 2019-05-01 | | | | |
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Abstract

This submission proposes resolutions for comments of TGba Draft D2.0 with the following CIDs: 2662, 2475, 2661, 2273, 2276, 2311, 2076, 2077, 2078, 2079, 2620, and 2692.

Note: All the cross-reference is with respect to TGba Draft 2.1

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 2662 | 83.39 | 31.1 | The Draft referes to MC-OOK modulation for WUR-Sync and WUR-Data, but the deinition of MC-OOK is missing. | Insert the following at Pg. 83 and Ln. 38 of Draft 2.0: "For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by MC-OOK, which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null." | Revised.  Agree in principle. Added MC-OOK definition in Clause 31.1 (Introduction). MC-OOK is defined as an On-Off Keying, modulated with a multicarrier signal. The multicarrier signal should be generated using contiguous 13 subcarriers, centered within a 20 MHz channel, with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2662. |
| 2475 | 83.39 | 31.1 | The definition of MC-OOK is missing. The definition was in D1.0 (P84L24) as follows "the OOK waveform of WUR PPDU is generated by using contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null." but removed with no clear reason. Also in the doc.:11-17/575r11 "Spec Framework Document", R3.3.B and R3.3.C, MC-OOK has been agreed to generate the OOK waveform. | Insert the definition of MC-OOK as follows in P83L43 of D2.0: "For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by MC-OOK, which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null." | Revised.  Agree in principle. Added MC-OOK definition in Clause 31.1 (Introduction). MC-OOK is defined as an On-Off Keying, modulated with a multicarrier signal. The multicarrier signal should be generated using contiguous 13 subcarriers, centered within a 20 MHz channel, with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2475. |
| 2661 | 83.38 | 31.1 | WUR signal Bandwidth is currently undefined in the spec D2.0. This can be very problematic, as the receiver performance cannot be gauranteed if the WUR signal bandwidth is arbitrary. | Insert the following at Pg. 83 and Ln. 38 of Draft 2.0: "For a WUR PPDU with 20 MHz channel width, the WUR-Sync and WUR-Data fields are generated by MC-OOK, which uses contiguous 13 subcarriers with a subcarrier spacing of 312.5 kHz and the center subcarrier being null." | Revised.  Agree in principle. Added MC-OOK definition in Clause 31.1 (Introduction). MC-OOK is defined as an On-Off Keying, modulated with a multicarrier signal. The multicarrier signal should be generated using contiguous 13 subcarriers, centered within a 20 MHz channel, with a subcarrier spacing of 312.5 kHz and the center subcarrier being null. This definition, along with transmit spectral mask, further defines the WUR signal bandwidth.  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2661. |
| 2273 | 84.11 | 32.2.9.2 | The text reads "The encoded binary data shall be modulated using MC-OOK". This sentence contains normative text stating that MC-OOK shall be used. However the current version of the draft does not define MC-OOK. Hence, normative text defining MC-OOK ought to be provided. | "Picking up on comments made in the previous letter ballot on D1.0, the TG did not properbly address the issue raised in the comment, nor does the TG provide an indication that the text commented on has been deleted and hence the comment does not apply. (Note, page and line and sublause number refer to D1.0). In fact, as stated in the TGba minutes (11-19/226r0), the intend of the task group was to ""Move to resolve CIDs that have no approved resolution as rejected with a reason read ""TGba is unable to reach consensus on a resolution"" in the interest of releasing draft 2.0"". Also, the statement """"TGba is unable to reach consensus on a resolution"" was added to the motion text there was one person speaking against the motion."" was only added to the motion after objection to the original motion trying to reject comments in bulk with the reason of releasing a new LB.  The TG is asked to give the original comment due consideration and debade the proposed comment resolution as included in 11-18/1794r10. The referenced document includes an actionable comment resolution." | Revised.  Agree in principle. Added MC-OOK definition in Clause 31.1 (Introduction). MC-OOK is defined as an On-Off Keying, modulated with a multicarrier signal. The multicarrier signal should be generated using contiguous 13 subcarriers, centered within a 20 MHz channel, with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2273. |
| 2276 | 78.62 | 32.2.7 | 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. | "Picking up on comments made in the previous letter ballot on D1.0, the TG did not properbly address the issue raised in the comment, nor does the TG provide an indication that the text commented on has been deleted and hence the comment does not apply. (Note, page and line and sublause number refer to D1.0). In fact, as stated in the TGba minutes (11-19/226r0), the intend of the task group was to ""Move to resolve CIDs that have no approved resolution as rejected with a reason read ""TGba is unable to reach consensus on a resolution"" in the interest of releasing draft 2.0"". Also, the statement """"TGba is unable to reach consensus on a resolution"" was added to the motion text there was one person speaking against the motion."" was only added to the motion after objection to the original motion trying to reject comments in bulk with the reason of releasing a new LB.  The TG is asked to give the original comment due consideration and debade the proposed comment resolution as included in 11-18/1794r10. The referenced document includes an actionable comment resolution." | Revised.  Agree in principle. Added MC-OOK definition in Clause 31.1 (Introduction). MC-OOK is defined as an On-Off Keying, modulated with a multicarrier signal. The multicarrier signal should be generated using contiguous 13 subcarriers, centered within a 20 MHz channel, with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2276. |
| 2311 | 65.08 | 32.1 | "Multicarrier On-Off Keying (MC-OOK)" is an incorrect term. The WUR signal defined in this spec is actually a single carrier signal using Manchester coded On-Off Keying modulation with 4 MHz bandwidth. Although the OOK signal may be generated by transmitting some symbols in multiple subcarriers of an OFDM symbol as one of possible methods, those symbols has no meaning to the typical WUR receiver, such as an envelope detector. | "Picking up on comments made in the previous letter ballot on D1.0, the TG did not properbly address the issue raised in the comment, nor does the TG provide an indication that the text commented on has been deleted and hence the comment does not apply. (Note, page and line and sublause number refer to D1.0). In fact, as stated in the TGba minutes (11-19/226r0), the intend of the task group was to ""Move to resolve CIDs that have no approved resolution as rejected with a reason read ""TGba is unable to reach consensus on a resolution"" in the interest of releasing draft 2.0"". Also, the statement """"TGba is unable to reach consensus on a resolution"" was added to the motion text there was one person speaking against the motion."" was only added to the motion after objection to the original motion trying to reject comments in bulk with the reason of releasing a new LB.  The TG is asked to give the original comment due consideration and debade the proposed comment resolution as included in 11-18/1794r10. The referenced document includes an actionable comment resolution." | Reject.  The TG had studied and debated on the feasibility of using “single carrier” and “multicarrier” for the generation of OOK waveform, and in the "Spec Framework Document" doc.:11-17/575r11, R3.3.B and R3.3.C, the TG had agreed to use MC-OOK for generating the OOK waveform.  Moreover, any OOK waveform cannot meet the minimum receive requirement defined in 802.11ba D2.1. The receive requirements were set based on the studies done using MC-OOK waveforms. |
| 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.  Agree with the comment that “2 µs MC-OOK” is not defined. “2 µs MC-OOK” is replaced with “2 µs duration MC-OOK” and added the MC-OOK definition in Clause 31.1 (Introduction).  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2076. |
| 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.  Agree with the comment that “2 µs MC-OOK” is not defined. “2 µs MC-OOK” is replaced with “2 µs duration MC-OOK” and added the MC-OOK definition in Clause 31.1 (Introduction).  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2077. |
| 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.  Agree with the comment that “4 µs MC-OOK” is not defined. “4 µs MC-OOK” is replaced with “4 µs duration MC-OOK” and added the MC-OOK definition in Clause 31.1 (Introduction).  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2078. |
| 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.  Agree with the comment that “4 µs MC-OOK” is not defined. “4 µs MC-OOK” is replaced with “4 µs duration MC-OOK” and added the MC-OOK definition in Clause 31.1 (Introduction).  TGba Editor to make changes as shown in 802.11-19/0710r4 with CID #2079. |
| 2620 | 19.09 | 3.2 | Multicarrier On-Off Keying (MC-OOK) is an incorrect term. A multicarrier signal is typically defined as the signal that carriers information bits in multiple frequencies at any given time. Although the 4 MHz OOK signal may be generated by transmitting some non-zero symbols at certain frequencies using OFDM signal generation mechanism as one of possible methods, those symbols has no meaning to the typical WUR receiver, such as an envelope detector. In addition, when time domain masking (e.g., "Select the first half of IDFT output" block in Figure 31-6 in Page 90) and cyclic shifts in Table AB-3 are applied to the OFDM signal for multi-antenna transmission as part of OOK signal generation process, the original information of the input symbol at the input of IDFT (i.e., subcarriers) have been destroyed. In other words, there will be no useful information at those frequencies/carriers anyway. Therefore, the waveform generated using the proposed method in the examples of this spec draft is not multicarrier waveform. | Change this term to "Manchester Coded On-Off Keying (MC-OOK)" or "Manchester-like Coded On-Off Keying" or simply Coded OOK (C-OOK). (This is the same comment and solution I gave for LB235. It was "rejected" due to "unable to reach consensus on a resolution") | Reject.  The TG had studied and debated on the feasibility of using “single carrier” and “multicarrier” for the generation of OOK waveform, and in the "Spec Framework Document" doc.:11-17/575r11, R3.3.B and R3.3.C, the TG had agreed to use MC-OOK for generating the OOK waveform.  Moreover, any OOK waveform cannot meet the minimum receive requirement defined in 802.11ba D2.1. The receive requirements were set based on the studies done using MC-OOK waveforms.  Envelope detection is only one possible implementation of WUR receiver. A more advanced WUR reciver may make use of the MC-OOK structure of the waveform.  Also, a potential receiver implementation can perform inverse operations for “time domain masking (Select the first half of IDFT output)”, “cyclic shift” etc. and can determine the symbols used by the transmitter at the input of IDFT. |
| 2692 | 19.09 | 3.2 | Regarding the definition of MC-OOK, is it really necessary to define it? For a WUR receiver, all it matters is that an OOK waveform was generated or received, I don't think it matters at all how the OOK is generated. | define OOK instead of MC-OOK | Reject.  The TG had studied and debated on the feasibility of using “single carrier” and “multicarrier” for the generation of OOK waveform, and in the "Spec Framework Document" doc.:11-17/575r11, R3.3.B and R3.3.C, the TG had agreed to use MC-OOK for generating the OOK waveform.  Moreover, any OOK waveform cannot meet the minimum receive requirement defined in 802.11ba D2.1. The receive requirements were set based on the studies done using MC-OOK waveforms. |

***TGba editor: Change the following paragraphs in 31.1 Introduction: (Track change on) (#2662, 2475, 2661, 2273, 2276, 2076, 2077, 2078, 2079)***

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

The WUR PHY uses the multicarrier on-off keying (MC-OOK) modulation for the WUR-Sync and WUR-Data fields. MC-OOK is defined as an on-off keying, modulated with a multicarrier signal. The multicarrier signal should be generated using contiguous 13 subcarriers, centered within a 20 MHz channel, with a subcarrier spacing of 312.5 kHz and the center subcarrier being null.The subcarrier coefficients may take values from the BPSK, QPSK, 16-QAM, 64-QAM, or 256-QAM constellation symbols.

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

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

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