### **IEEE P802.11 Wireless LANs**

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| Comment Resolutions on Correlation Test | | | | |
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**Abstract**

The document provides comment resolutions for CIDs: 5017, 5018, 5020 and 5021.

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| **CID** | **Clause** | **Page**  **/Line** | **Comment** | **Proposed Change** | **Resolution** |
| 5017 | Annex AC | 181/33 | As was shown in document IEEE 802.11-19/1120r0, Example 3 in Table AC-1 does not meet the Correlation Test in Subclause 30.3.12.5 and hence it should not be listed as an example in Annex AC, and should be removed. | Delete the Row for Example 3 in Table AC-1. Also delete the sentences on Lines 5-9 on Page 184. At the end of the paragraph ending on Page 183 Line 60 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." At the end of the paragraph ending on Page 184 Line 3 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-20/78r0 |
| 5018 | Annex AC | 184/17 | As was shown in document IEEE 802.11-19/1120r0, all three examples in Table AC-2 do not meet the Correlation Test in Subclause 30.3.12.5 and hence they should not be listed as an example in Annex AC, and should be removed. New examples should be added to the table to replace those examples. | In Table AC-2 replace Example 1 with the following: "{-1, 1, 1, 1, -1, 1, 0, -1, -1, -1, 1, -1, -1}." Delete the rows for Examples 2 & 3 in Table AC-2. Also delete the fourth row with the comment about scaling for Example 2. Delete the sentence on Page 184 Lines 50-51 which states "This sequence also has the lowest PAPR among the BPSK MC-OOK On symbols for a single channel transmission."  At the end of the paragraph ending on Page 184 Line 51 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5."  Delete the paragraph on Page 184 Lines 53-59. Delete the paragraph on Page 184 Line 61-65. | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-20/78r0 |
| 5020 | Annex AC | 183/33 | As was shown in document IEEE 802.11-19/1120r0, Example 3 in Table AC-1 does not meet the Correlation Test in Subclause 30.3.12.5 and hence it should not be listed as an example in Annex AC, and should be removed. | Delete the Row for Example 3 in Table AC-1. Also delete the sentences on Lines 5-9 on Page 184. At the end of the paragraph ending on Page 183 Line 60 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." At the end of the paragraph ending on Page 184 Line 3 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-20/78r0 |
| 5021 | Annex AC | 184/17 | As was shown in document IEEE 802.11-19/1120r0, all three examples in Table AC-2 do not meet the Correlation Test in Subclause 30.3.12.5 and hence they should not be listed as an example in Annex AC, and should be removed. New examples should be added to the table to replace those examples. | In Table AC-2 replace Example 1 with the following: "{-1, 1, 1, 1, -1, 1, 0, -1, -1, -1, 1, -1, -1}." Delete the rows for Examples 2 & 3 in Table AC-2. Also delete the fourth row with the comment about scaling for Example 2. Delete the sentence on Page 184 Lines 50-51 which states "This sequence also has the lowest PAPR among the BPSK MC-OOK On symbols for a single channel transmission."  At the end of the paragraph ending on Page 184 Line 51 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5."  Delete the paragraph on Page 184 Lines 53-59. Delete the paragraph on Page 184 Line 61-65. | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-20/78r0 |

**Discussion**

The comments are related to that fact that not all the MC-OOK example symbols in Annex AC meet the Correlation Test in Subclause 30.3.12.5. The proposed resolution is to keep the MC-OOK symbols that meet the Correlation Test and to replace the other symbols with new symbols that meet the correlation test.

**Proposed Resolution**

TGba Editor make the following changes to Draft 5.0,

Examples of WUR MC-OOK Symbol Design and CSD Design

Subclauses 30.3.4.1 (WUR Basic PPDU waveform generation for WUR-Sync field and WUR-Data field with WUR HDR), 30.3.4.2 (WUR Basic PPDU waveform generation for WUR-Data field with WUR LDR), and 30.3.4.3 (WUR FDMA PPDU WUR-Data field waveform generation) provides a description of how the 2 µs duration MC-OOK and 4 µs duration MC-OOK On and Off Symbols might be constructed but does not provide the actual frequency domain sequences for those symbols. This annex provides example sequences for the construction of these symbols.

Table AC-1 (Example Values for the Sequence SHDR used for the Construction of the 2 µs duration MC-OOK On Symbol) provides example sequences for the construction of the 2 µs duration MC-OOK On Symbol.

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| --- | --- |
| * Example Values for the Sequence *SHDR* used for the Construction of the 2 µs duration MC-OOK On Symbol | |
| Index | Sequence *SHDR* |
| Example 1 |  |
| Example 2 |  |
| Example 3 | {3+5j, 0, -7+5j, 0, -7-5j, 0, 0, 0, -5+1j, 0, 7+7j, 0, 5-5j} |
| NOTE—For all three Examples, the scaling factors are chosen so that the MC-OOK On Symbol is normalized to have the same power as the other examples. | |

Example 1 in Table AC-1 (Example Values for the Sequence SHDR used for the Construction of the 2 µs duration MC-OOK On Symbol) is evaluated under a number of channel conditions and shows consistent good performance in both multipath fading and additive white Gaussian noise channels. This sequence also has low PAPR for a single channel transmission. This sequence meets the Correlation Test in Subclause 30.3.12.5.

Example 2 in Table AC-1 (Example Values for the Sequence SHDR used for the Construction of the 2 µs duration MC-OOK On Symbol) is designed to provide good performance in commonly found propagation conditions, including the additive white Gaussian noise channel. This MC-OOK On Symbol has nearly constant envelope and power distributed over the full bandwidth. Therefore, it might be transmitted with an output power higher than during the L-STF, L-LTF and L-SIG. This sequence meets the Correlation Test in Subclause 30.3.12.5.

Example 3 in Table AC-1 (Example Values for the Sequence SHDR used for the Construction of the 2 µs duration MC-OOK On Symbol) is found to provide good performance through exhaustive search among the OFDM symbols with BPSK modulation. This sequence is optimized for good tradeoff between multipath fading channel performance and PAPR. This sequence meets the Correlation Test in Subclause 30.3.12.5.

Table AC-2 (Example Values for the Sequence SLDR used for the Construction of the 4 µs duration MC-OOK On Symbol) provides example sequences for the construction of the 4 µs duration MC-OOK On Symbol.

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| --- | --- |
| * Example Values for the Sequence *SLDR* used for the Construction of the 4 µs duration MC-OOK On Symbol | |
| Index | Sequence *SLDR* |
| Example 1 | {-1, 1, 1, 1, -1, 1, 0, -1, -1, -1, 1, -1, -1} |
| Example 2 |  |
| Example 3 | {-1+j, 1+j, -1+j, 1+j, -1-j, 1-j, 0, 1-j, 1+j, -1-j, -1-j, 1+j, 1+1j} |
| NOTE—For Examples 2 and 3, the scaling factors are chosen so that the MC-OOK On Symbol is normalized to have the same power as the other examples. | |

Example 1 in Table AC-2 (Example Values for the Sequence SLDR used for the Construction of the 4 µs duration MC-OOK On Symbol) is evaluated under a number of channel conditions and shows consistent good performance in both multipath fading and additive white Gaussian noise channels. This sequence meets the Correlation Test in Subclause 30.3.12.5.

Example 2 in Table AC-2 (Example Values for the Sequence SLDR used for the Construction of the 4 µs duration MC-OOK On Symbol) is designed to provide good performance in commonly found propagation conditions, including the additive white Gaussian noise channel. This MC-OOK On Symbol has a nearly constant envelope and has power distributed over the full bandwidth. Therefore, it might be transmitted with an output power higher than during the L-STF, L-LTF and L-SIG. This sequence meets the Correlation Test in Subclause 30.3.12.5.

Example 3 in Table AC-2 (Example Values for the Sequence SLDR used for the Construction of the 4 µs duration MC-OOK On Symbol) is found to provide good performance through exhaustive search among the OFDM symbols with BPSK modulation. This sequence is optimized for good tradeoff between multipath fading channel performance and PAPR. This sequence meets the Correlation Test in Subclause 30.3.12.5.

For the WUR-Sync field and the HDR WUR-Data field, which are both constructed from 2 µs duration MC-OOK symbols, Table AC-3 (Recommended CSD values for the WUR-Sync field and WUR-Data field with WUR HDR) provides recommended CSD values for one to eight transmit antennas, for each of the three recommended MC-OOK symbols from Table AC-1 (Example Values for the Sequence SHDR used for the Construction of the 2 µs duration MC-OOK On Symbol).

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| --- | --- | --- |
| * Recommended CSD values for the WUR-Sync field and WUR-Data field with WUR HDR | | |
| Example Sequence | Number of Transmit Chains | CSD Values (ns) |
| Example 1 | 1 | [0] |
| 2 | [0, -600] |
| 3 | [0, -600, -1100] |
| 4 | [0, -600, -1100, -1350] |
| 5 | [0, -600, -1100, -1350, -350] |
| 6 | [0, -600, -1100, -1350, -350, -850] |
| 7 | [0, -600, -1100, -1350, -350, -850, -600] |
| 8 | [0, -600, -1100, -1350, -350, -850, -600, -1350] |
| Example 2 | 1 | [0] |
| 2 | [0, -100] |
| 3 | [0, -850, -100] |
| 4 | [0, -1100, -600, -100] |
| 5 | [0, -1200, -850, -450, -100] |
| 6 | [0, -1300, -1000, -700, -400, -100] |
| 7 | [0, -1350, -1100, -850, -600, -350, -100] |
| 8 | [0, -1400, -1150, -950, -750, -550, -300, -100] |
| Example 3 | 1 | [0] |
| 2 | [0, -100] |
| 3 | [0, -850, -100] |
| 4 | [0, -1100, -600, -100] |
| 5 | [0, -1200, -850, -450, -100] |
| 6 | [0, -1300, -1000, -700, -400, -100] |
| 7 | [0, -1350, -1100, -850, -600, -350, -100] |
| 8 | [0, -1400, -1150, -950, -750, -550, -300, -100] |

For the LDR WUR-Data field, which is constructed from 4 µs duration MC-OOK symbols, Table AC-4 (Recommended CSD values for the WUR-Data field with WUR LDR) provides recommended CSD values for one to eight transmit antennas, for each of the three recommended MC-OOK symbols from Table AC-2 (Example Values for the Sequence SLDR used for the Construction of the 4 µs duration MC-OOK On Symbol).

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| * Recommended CSD values for the WUR-Data field with WUR LDR | | |
| Example Sequence | Number of Transmit Chains | CSD Values (ns) |
| Example 1 | 1 | [0] |
| 2 | [0, -1200] |
| 3 | [0, -1200, -2200] |
| 4 | [0, -1200, -2200, -2700] |
| 5 | [0, -1200, -2200, -2700, -700] |
| 6 | [0, -1200, -2200, -2700, -700, -1700] |
| 7 | [0, -1200, -2200, -2700, -700, -1700, -1200] |
| 8 | [0, -1200, -2200, -2700, -700, -1700, -1200, -2700] |
| Example 2 | 1 | [0] |
| 2 | [0, -200] |
| 3 | [0, -1700, -200] |
| 4 | [0, -2200, -1200, -200] |
| 5 | [0, -2450, -1700, -950, -200] |
| 6 | [0, -2600, -2000, -1400, -800, -200] |
| 7 | [0, -2700, -2200, -1700, -1200, -700, -200] |
| 8 | [0, -2750, -2350, -1900, -1500, -1050, -650, -200] |
| Example 3 | 1 | [0] |
| 2 | [0, -200] |
| 3 | [0, -1700, -200] |
| 4 | [0, -2200, -1200, -200] |
| 5 | [0, -2450, -1700, -950, -200] |
| 6 | [0, -2600, -2000, -1400, -800, -200] |
| 7 | [0, -2700, -2200, -1700, -1200, -700, -200] |
| 8 | [0, -2750, -2350, -1900, -1500, -1050, -650, -200] |