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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Comment Resolutions on Correlation Test | | | | |
| Date: 2019-11-11 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | Email |
| Steve Shellhammer | Qualcomm |  |  | shellhammer@ieee.org |
|  |  |  |  |  |

**Abstract**

The document provides comment resolutions for CIDs: 4070, 4077, 4078, 4097, 4116, 4117, 4138.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Page**  **/Line** | **Comment** | **Proposed Change** | **Resolution** |
| 4070 | 30.3.12.5 | 162/16 | N=6 | N=6 is correct? Should N be 5 (5\*0.8=4us) to cover the worst case scenarios | **Rejected**  The choice of *N* is based on the legacy receiver and not on the 802.11ba waveform |
| 4097 | 30.3.12.5 | 162/16 | "N=6" | Why N=6? Should N=5 (N\*0.8=4us) to cover the worst case: 2 consecutive 2us "ON" waveform or 1 4us "ON" waveform? | **Rejected**  The choice of *N* is based on the legacy receiver and not on the 802.11ba waveform |
| 4077 | Annex AD | 181/33 | As was shown in document IEEE 802.11-19/1120r0, Example 3 in Table AD-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 AD, and should be removed. | Delete the Row for Example 3 in Table AD-1. Also delete the following sentences on Lines 6-10 on Page 182. At the end of the paragraph ending on Page 181 Line 61 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." At the end of the paragraph ending on Page 182 Line 4 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-19/1882r0 |
| 4078 | Annex AD | 182/18 | As was shown in document IEEE 802.11-19/1120r0, all three examples in Table AD-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 AD, and should be removed. New examples should be added to the table to replace those examples. | In Table AD-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 AD-2. Also delete the fourth row with the comment about scaling for Example 2. Delete the sentence on Page 182 Lines 51-53 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 182 Line 53 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5."  Delete the paragraph on Page 182 Lines 56-61. Delete the paragraph on Page 182 Line 64 to Page 183 Line 2. | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-19/1882r0 |
| 4116 | Annex AD | 181/33 | As was shown in document IEEE 802.11-19/1120r0, Example 3 in Table AD-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 AD, and should be removed. | Delete the Row for Example 3 in Table AD-1. Also delete the following sentences on Lines 6-10 on Page 182. At the end of the paragraph ending on Page 181 Line 61 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." At the end of the paragraph ending on Page 182 Line 4 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5." | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-19/1882r0 |
| 4117 | Annex AD | 182/18 | As was shown in document IEEE 802.11-19/1120r0, all three examples in Table AD-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 AD, and should be removed. New examples should be added to the table to replace those examples. | In Table AD-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 AD-2. Also delete the fourth row with the comment about scaling for Example 2. Delete the sentence on Page 182 Lines 51-53 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 182 Line 53 add the sentence: "This symbol meets the Correlation Test in Subclause 30.3.12.5."  Delete the paragraph on Page 182 Lines 56-61. Delete the paragraph on Page 182 Line 64 to Page 183 Line 2. | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-19/1882r0 |
| 4138 | Annex AD | 181/33 | Some of the examples in Annex AD seem to have correlation metric higher than 0.4 (see 30.3.12.5). | Ensure (by replacing examples if needed) that the examples MC-OOK symbols in Annex AD meets the correlation metric requirement specified in 30.3.12.5. | **Revised**  TGba Editor makes changes as shown in IEEE 802.11-19/1882r0 |

**Discussion**

Two of the comments (4070 and 4097) ask about the value of N in the Correlation Test. Both comments indicate (or ask if) a better value of would be , since 5 times the time segment duration of 0.8 µs gives 4 µs, which is the duration of an MC-OOK symbol for the LDR. However, the choice of N is based on what is typically implemented in a legacy (non-WUR) receiver. The legacy short training field (STF) consists of ten short training sequences, each of duration 0.8 µs. Legacy receivers typically budget a few short training sequences for automatic gain control, and then use the remainder for L-STF detection. The value of is a typical value used in a typical legacy receiver, but other values are possible. Hence the value of is an appropriate value for the Correlation Test. So those two comments are rejected.

Five comments (4077, 4078, 4116, 4117, 4138) are related to that fact that not all the MC-OOK example symbols in Annex AD 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 4.0,



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 high data rate WUR-Data field), 30.3.4.2 (WUR Basic PPDU waveform generation for low data rate WUR-Data field), 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 AD-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.

|  |  |
| --- | --- |
| * 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 |  |
|  |  |
| NOTE—For Example 2, the scaling factor has been chosen so that the MC-OOK On symbol is normalized to have the same power as the other examples. | |

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

Example 2 in Table AD-1 (Example Values for the Sequence SHDR used for the Construction of the 2 µs duration MC-OOK On symbol) has been 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.

Table AD-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.

|  |  |
| --- | --- |
| * 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 1 in Table AD-2 (Example Values for the Sequence SLDR used for the Construction of the 4 µs duration MC-OOK On symbol) has been evaluated under a number of channel conditions and has shown consistent good performance in both multipath fading and additive white Gaussian noise channels. This sequence also has the lowest PAPR among the BPSK MC-OOK On symbols for a single channel transmission. This sequence meets the Correlation Test in Subclause 30.3.12.5.