IEEE P802.11
Wireless LANs

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| Clause 21 SC 64QAM |
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Abstract

This document provides the details of the changes needed for adding 64QAM to the SC PHY subclause

**Discussion (1):**

*TBD*

***Editor: replace the penultimate row of table 21-17 (SC header fields) with the following two lines:***

|  |  |  |  |
| --- | --- | --- | --- |
| 64QAM indication | 2 | 44 | bits L0,L1 (L0 is at position 44 in the header field). If any of these bits is 1, the MCS is 64QAM, with the same code rate indicated by the MCS field. When any of these bits is set, the only valid values for the MCS fieid are 7-9. They are also used in the indication of the length of the packet in the case of 64QAM |
| Reserved | 2 | 46 | set to 0, ignored by receiver |

***Editor: add the following text to the description of the length field in table 21-17 (SC header fields):***

If any of the bits of the 64QAM indication field (L0, L1) is 1, the number of data octets in the packet is L=3xL’-2xL1-L0+1, where L’ is the value in the length field. In this case the value in the length field shall not exceed 87381.

***Editor: add the following lines (at the end) to table 21-18 (Modulation and coding scheme for SC):***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 7bis | π/2-64QAM | 6 | 1 | 5/8 | 5775 |
| 8bis | π/2-64QAM | 6 | 1 | ¾ | 6930 |
| 9bis | π/2-64QAM | 6 | 1 | 13/16 | 7507.5 |

***Editor: add the following subclause after subclause 21.6.3.2.4.4:***

**21.6.3.2.4.5 π/2-64QAM Modulation**

In the π/2-64QAM modulation, the input bit stream is grouped in sets of 6 bits and mapped according to the following equation:

$$\tilde{s}\_{k}=\frac{1}{\sqrt{42}}\left(\left(8c\_{6k}-4\right)+\left(2c\_{6k}-1\right)\left(4c\_{6k+1}-2\right)+\left(2c\_{6k}-1\right)\left(2c\_{6k+1}-1\right)\left(2c\_{6k+2}-1\right)\right)+\frac{j}{\sqrt{42}}\left(\left(8c\_{6k+3}-4\right)+\left(2c\_{6k+3}-1\right)\left(4c\_{6k+4}-2\right)+\left(2c\_{6k+3}-1\right)\left(2c\_{6k+4}-1\right)\left(2c\_{6k+5}-1\right)\right)$$

where k is the output symbol index, k=0,1, …. Each output symbol is then rotated according to the following equation $s\_{k}=\tilde{s}\_{k}∙e^{\frac{jπk}{2}}.$ The constellation bit encoding is depicted in Figure 1-64QAM constellation bit encoding.



Figure 1-64QAM constellation bit encoding

***Editor: Add the following subclause after subclause 21.6.3.2.5***

**21.6.3.2.6 Interleaver for 64QAM blocks**

In the case of π/2-64QAM modulation, each block of 448 symbols will be interleaved according to the following formula: Value at index k at interleaver output equals value at index k' at interleaver input,

where:

$$k=4r\left⌊\frac{k^{'}⨁112}{r}\right⌋+r\left⌊\frac{k^{'}}{112}\right⌋+k^{'}⨁r, k^{'}=0,1,…,447$$

k,k’ are the indices in the symbol block after and before the interleaver respectively. $\left⌊x\right⌋$ indicates the floor operation - $\left⌊x\right⌋$ is the largest integer smaller or equal to$ x$. $r=16$ is the blocking size. $⨁$ is the modulo operation (remainder).

Note: This interleaver provides improved resilience to phase noise.

***Editor: Add the following lines to table 21-20 (Values of NCBPB)***

|  |  |
| --- | --- |
| π/2-64QAM | 2688 |

***Editor: Add the following lines to table 21-21 (EVM requirements of DMG SC mode)***

|  |  |  |  |
| --- | --- | --- | --- |
| 7bis | π/2-64QAM | 5/8 | -26 |
| 8bis | π/2-64QAM | ¾ | -27 |
| 9bis | π/2-64QAM | 13/16 | -29 |

***Editor: add the following line to table 21-1 after the MCS line:***

|  |  |  |  |
| --- | --- | --- | --- |
| SC64QAM | Enumerated type: NON\_SC64QAM: indicates regular interpretation of the MCS fieldSC64QAM: indicates that MCS 7-9 represent 64QAM Modulations rather than QPSK Modulation with the same code rate. This field is valid only when the MCS field is 7-9. | **Y** | **Y** |

***Editor: in figure 8-503, replace field B22 – B23 "reserved" with two fields: B22 – "64QAM supported", and B23 – "reserved".***

***Editor: modify the text in P1023L23-26 as follows:***

The Maximum SC Rx MCS subfield contains the value of the maximum MCS index the STA supports for reception of single-carrier frames. Values 0-3 of this (#3097) subfield are reserved. Possible values for this subfield are shown in Table 21-18 (Modulation and coding scheme for SC) (values for 64QAM MCSs are not valid for this field).

***Editor: modify the text in P1023L23-26 as follows:***

The Maximum SC Tx MCS subfield contains the value of the maximum MCS index the STA supports for transmission of single-carrierframes. Values 0-3 of this (#3097)subfield are reserved. Possible values for this subfield are shown in Table 21-18 (Modulation and coding scheme for SC) (values for 64QAM MCSs are not valid for this field).

***Editor: Add the following text after line 56 in page 1023:***

The 64QAM subfield specifies whether the STA supports 64QAM in SC mode in both transmission and reception. This field is valid only if the Maximum SC Tx MCS and the Maximum SC Rx MCS fields are set to 12 and the Code Rate 13/16 subfield is set to 1.

***Editor: Modify the text in P1044L39-43 (in subclause 8.4.2.141.1)***

The MCS field is set to an MCS value that the STA sending this element recommends that the peer STA indicated in the RA field of the Link Measurement Report frame use to transmit frames to this STA. The reference PER for selection of the MCS is 10-2 for an MPDU length of 4096 octets. The method by which the sending STA determines a suitable MCS for the peer STA is implementation specific. If the most significant bit of the MCS field is set to 1, and the lower 7 bits indicate values of 7-9, the MCS should be interpreted as a 64QAM MCS, with code rates of 5/8, ¾, 13/16, for lower bits values of 7,8,9 respectively. The most significant bit of the MCS field is set to 1 only if the receiving STA indicated 64QAM capability in the Supported MCS set.

**References:**