IEEE P802.11  
Wireless LANs

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| Comment Resolutions on DCM TBDs | | | | |
| Date: 2016-07-13 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Sriram Venkateswaran  Ron Porat | Broadcom | 190 Mathilda Place, Sunnyvale, CA 94096 | +1-408-922-7684 | sriram.venkateswaran@broadcom.com |

Abstract

This submission proposes resolutions for the following comments related to TGax D0.1:

* 482, 1867, 2084, 2085

Revisions:

* Rev 0: Initial version of the document.

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

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| **CID** | **Clause Number** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 482 | 26.3.10.8 | 143, 50 | remove TBD sentence or finalize details of DCM constellation. | Complete the TBD aspects of DCM, or remove support of DCM for BPSK and 16-QAM. | Revised.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-16/xxr0 |
| 1867 | 26.3.10.8 | 143, 37 | Consider DCM as a spreading mechanism, and then introduce appropriate phase rotation to reduce the overall peak to average ratio. | One example of the phase rotation to be introduced is alternate inversion, i.e. pi-rotation of each alternate sub-carrier number k. Or other random sequence with k and less than pi rotation. | Accepted, resolution accounts for the suggested change.  Proposed DCM constellation has inbuilt phase rotation.  BPSK upper half has the alternating pi-rotation proposed. QPSK upper half is a conjugated version of lower half. With 16-QAM, in the upper half, the bits are permuted before mapping to a constellation point. |
| 2084 | 26.3.10.8 | 143, 35 | No need for separate function q(k) | Since q(k) is now known to be simply k+N\_SD/2, remove all occurrences of q(k) | Proposed resolution accounts for the suggested change.  Retained q(k) in the initial paragraph about maximizing diversity, because it helps in explaining the concept.  Removed q(k) in subsequent descriptions of DCM with BPSK/QPSK/16-QAM and replaced with k + NSD. |
| 2085 | 26.3.10.8 | 143, 50 | TBD | Define | Revised.  Proposed resolution accounts for the suggested change.  TGax Editor to make the changes shown in IEEE 802.11-16/xxr0 |

*Changes to D0.2 related to CID 482, 1867, 2084, 2085*

Section 26.3.10.7, page 145, line 30-31 (D0.2)

Add the following after the line “*The BCC interleaver operation is specified in 22.3.10.8 (BCC interleaver).”*

For the case where DCM is used with BPSK modulation in a 106-RU or a 242-RU with *Nss =* 1*,* after the 2×*Ndbps* coded bits in each OFDM symbol, 1 padding bit is added before the bits are interleaved.

Section 26.3.10.8, page 145, line 61-62

Replace *“Dual sub-carrier modulation (DCM) is an optional modulation scheme for the HE-SIG-B and Data fields. DCM is only applied to BPSK, QPSK and 16-QAM modulations. DCM is only applied to BPSK, QPSK and 16-QAM modulations*” with the following –

Dual sub-carrier modulation (DCM) is an optional modulation scheme for the HE-SIG-B and Data fields. DCM can be applied to HE SU PPDU and HE extended range SU PPDU. In an HE MU PPDU, DCM can be applied only to RUs containing data for 1 user.

DCM is only applied to MCS0, MCS 1, MCS 3 and MCS 4. DCM is applied only with Nss = 1 or 2 (in the case of single user RU in an HE MU PPDU, Nss,r,u = 1 or 2). The STA can indicate its DCM capability with regard to the largest constellation and the maximum number of streams supported. The STA uses 2 bits to indicate the largest constellation supported with DCM as described in Table YY-1. Similarly, the STA indicates the maximum Nss it supports with DCM via a single bit as in Table YY-2.

Table YY-1: Largest constellation supported with DCM

|  |  |
| --- | --- |
| **Bits** | **Interpretation** |
|  |  |
| 00 | Does not support DCM |
| 01 | BPSK |
| 10 | QPSK |
| 11 | 16-QAM |

Table YY-2: Maximum number of streams supported with DCM

|  |  |
| --- | --- |
| **Bits** | **Interpretation** |
|  |  |
| 0 | Only Nss = 1 supported |
| 1 | Nss = 1 and Nss = 2 supported |

DCM is not applied with MU-MIMO or with STBC.

Section 26.3.10.8, page 146, line 4 (D0.2)

Note to editor: We have redefined *NSD* with DCM = 1 to be half the value with of NSD with DCM = 0, hence the following changes.

Replace *0 ≤ k ≤ (NSD/2) – 1* with *0 ≤ k ≤ NSD – 1.*

Replace *(NSD/2) ≤ k ≤ NSD – 1* with *NSD ≤ k ≤ 2NSD – 1.*

Section 26.3.10.8, page 146, line 6 (D0.2)

Replace *q(k) = k + (NSD/2)* with *q(k) = k + NSD*

and add the following line The *N*SD here refers to the *N*SD with DCM = 1, which is half the value of *N*SD with DCM = 0.

Section 26.3.10.8, page 146, Add the following lines at line 8 (D0.2)

For BPSK modulation with DCM, the input stream is broken into groups of *Ncbps* or *Ncbps,ru* bits (*B0, B1,* …, *BNcbps,ru-1).* Each bit *B*k is BPSK modulated to a sample *dk*. This generates the samples for the lower half of the data subcarriers. For the upper half of the subcarriers, the samples are generated as



*N*SD here refers to the *N*SD with DCM = 1, which is half the value of *N*SD with DCM = 0.

Section 26.3.10.8, page 146, line 12-13 (D0.2)

In the sentence beginning “For the upper half of the data sub-carriers …”

replace

*dq(k)* = conj(*dk*) with *dk+NSD* = conj(*dk*)

Section 26.3.10.8, page 146, line 16 (D0.2)

Replace the line “*For BPSK and 16-QAM modulation with DCM, the constellation mapping is TBD*.” with the following

For 16-QAM modulation with DCM, the input stream is broken into groups of *Ncbps* or *Ncbps,ru* bits (*B0, B1,* …, *BNcbps,ru-1).* A group of 4 bits (*B4k, B4k+1, B4k+2, B4k+3)* is 16-QAM modulated to a sample *dk*  as described in Section 18.3.5.8. This is the sample on the *kth* subcarrier in the lower half. In the upper half, the sample *dk+NSD* on subcarrier *k+NSD* is obtained by 16-QAM modulating a permutation of the bits (*B4k, B4k+1, B4k+2, B4k+3)*. Specifically, *dk+NSD* is obtained by applying the 16-QAM modulation procedure in Section 18.3.5.8 to the bit group (*B4k+1, B4k, B4k+3, B4k+2).*

*N*SD here refers to the *N*SD with DCM = 1, which is half the value of *N*SD with DCM = 0.