IEEE P802.11
Wireless LANs

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| PHY CIDs on DCM for D7.0 |
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Abstract:

This document contains comment resolutions on the following CIDs in draft 7.0:

25006, 25007 and 25008.

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| **CID** | **Clause** | **Page** | **Line** | **Comment** | **Proposed Change** | **Resolution** |
| 25006 | 27.3.9 | 566 | 12 | On behalf of Brian Hart:The Nsd that is defined in table 27-13 is different for 80+80 vs 160 but the same for DCM for non-DCM and all bandwidths (for non-OFDMA HE modulated portions) yet the Nsd that is defined in section 27.5.7, has no differentiation between 80+80 vs 160, but does have differentation for non-DCM vs DCM (including for non-OFDMA 160 and 80+80MHz). | Option A: Delete Nsd from table 27-13 and refer to section 27.5 instead. But if this breaks things then Option B: Change the name of one or both of these Nsd's (e.g Nsd,ppdu and Nsd,ru) and review each usage of Nsd in the draft to determine if "Nsd,ppdu" or "Nsd,ru" is needed then make the change |  Revised:Agree with the commenter that $N\_{SD}$ described in section 27.3.9 only for the case DCM=0. We can change the description of $N\_{SD} $in the table Table 27-13 and Table 27-14 for clarification11ax editor, please make changes related to the discussion of CID 25006 in doc https://mentor.ieee.org/802.11/dcn/20/11-20-1664-02-00ax-phy-cids-on-dcm-for-d7-0.docx. |

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| 25007 | 27.3.12.9 | 646 | 22 | On behalf of Brian Hart:"Maximize frequency diversity" is not true for 2x996 because DCM modulation is per frequency subblock | Try "If DCM is employed, bit sequences are mapped to a pair of symbols d’k,d’qk where: • k is in the range of 0<=k<=Nsd-1 and qk is in the range of Nsd <= qk <= 2Nsd-1 for a 996-tone or smaller RU, and • k is in the range of 0<=k<=Nsd/2-1 and qk is in the range of Nsd/2<=qk<=Nsd-1 for each frequency subblock of a 2×996-tone RU. To maximize the frequency diversity, the indices of a pair of DCM subcarriers (k,qk) is qk=k+Nsd for a 996-tone or smaller RU. To provide a large measure of frequency diversity, the indices of a pair of DCM subcarriers (k,qk) is qk=k+Nsd/2 for a 2×996-tone RU." | Revised:Agree with the commenter in principle. For 2x996 RU, DCM implementation is to reduce the complexity and does not maximize the frequency diversity.11ax editor, please make changes related to the discussion of CID 25007 in doc https://mentor.ieee.org/802.11/dcn/20/11-20-1664-02-00ax-phy-cids-on-dcm-for-d7-0.docx. |
| 25008 | 27.3.12.9 | 646 | 31 | On behalf of Brian Hart:DCM description does not extend to 160MHz. | This affects the BPSK. QPSK and 16QAM paragraphs, each of which need to be fixed. As an example fix, just for BPSK, try: "Define NfreqSubblocks,ru as 1 for all RUs except NfreqSubblocks,ru equals 2 for 2x996 tone RUs. For BPSK modulation with DCM, the input stream of a frequency subblock is broken into groups of N CBPS/NfreqSubblocks,ru or N CBPS,u/NfreqSubblocks,ru bits (B0,B1,Bcbps,u/NfreqSubblocks,ru-1). Each bit Bk is BPSK modulated to a sample d’k. This generates the samples for the lower half of the data subcarriers in a frequency subblock. For the upper half of the data subcarriers in a frequency subblock, the samples are generated as d’q(k) = d’k\*exp(jq(k)pi), k=0,1,..Nsd/NfreqSubblocks,ru-1. The Nsd here refers to the Nsd with DCM = 1, which is half the value of Nsd with DCM = 0 (see sections 27.5 and 27.6). " | Revised.Agree with the commenter in principle. For 2x996 RU, DCM is different from DCM for a 996-tone or smaller RU. DCM is applied to each 996 RU of 2x996 RU separately. 11ax editor, please make changes related to the discussion of CID 25008 in doc https://mentor.ieee.org/802.11/dcn/20/11-20-1664-02-00ax-phy-cids-on-dcm-for-d7-0.docx. |

**Discussions for CID 25006:**

Agree with the commenter that $N\_{SD}$ described in section 27.3.9 only for the case DCM=0.

***TGax Editor: Please make the following changes (changed texts are in red) on page 566 of D7.0 (Table 27-13):***

Replace the five middle columns on the row NSD in the table with “See 27.5”. Straddle the five cells.

Delete the Note in the table.

***TGax Editor: Please make the following changes (changed texts are in red) on page 566 of D7.0 (Table 27-14):***

Replace the five middle columns on the row NSD in the table with “See 27.5”. Straddle the five cells.

Delete the Note in the table.

**Discussions for CID 25007:**

Agree with the commenter in principle. For 2x996 RU, DCM implementation is to reduce the complexity and does not maximize the frequency diversity.

***TGax Editor: Please make the following changes (changed texts are in red) in the Line 22 to line 24 on page 649 of D7.0 (Table 27-14):***

To maximize the frequency diversity, the indices of a pair of DCM subcarriers $(k,q\left(k\right)$ are given by $q\left(k\right)=q+N\_{SD} $for a 996-tone or smaller RU. To reduce the implementation complexity, the indices of a pair of DCM subcarriers $(k,q\left(k\right))$ are given by $q\left(k\right)=q+N\_{SD}/2 $for a 2×996-tone RU.

**Discussions for CID 25008:**

Agree with the commenter in principle. For 2x996 RU, DCM is different from DCM for a 996-tone or smaller RU. DCM is applied to each 996 RU of 2x996 RU separately.

***TGax Editor: Please make the following changes (changed texts are in red) in the Line 22 to line 24 on page 649 of D7.0 (Table 27-14):***

Let $N\_{80seg,ru}=1$ for a 996-tone or smaller RU and $N\_{80seg,ru}=2$ for a 2x996 tone RU.

For BPSK modulation with DCM, the input stream is broken into groups of *NCBPS*/$N\_{80seg,ru}$ or *NCBPS,u* /$N\_{80seg,ru} $bits ($B\_{0}, B\_{1},…, B\_{N\_{CBPS}/N\_{80seg,ru}}-1$). Each bit *Bk* is BPSK modulated to a sample. This generates the samples for the lower half of the data subcarriers. For the upper half of the subcarriers, the samples are generated as $d'\_{k+N\_{SD}/N\_{80seg,ru}}=d'\_{k}×e^{j(k+N\_{SD}/N\_{80seg,ru})π}, k=0,1,…, N\_{SD}/N\_{80seg,ru}-$1. The *NSD* here refers to the *NSD* with DCM = 1, which is half the value of *NSD* with DCM = 0.

For QPSK modulation with DCM, the input stream is broken into groups of *NCBPS*/$N\_{80seg,ru}$ or *NCBPS,u* /$N\_{80seg,ru}$bits $(B\_{0}, B\_{1},…, B\_{N\_{CBPS}/N\_{80seg,ru}}-1)$. Each pair of bits  is QPSK modulated to a symbol . This generates the constellation points for the lower half the data subcarriers in the RU. For the upper half of the data subcarriers in the RU, $d'\_{k+N\_{SD}/N\_{80seg,ru}}=conj(d'\_{k})$, where *conj*() represents the complex conjugate operation. The *NSD* here refers to the *NSD* with DCM = 1, which is half the value of *NSD* with DCM = 0.

For 16-QAM modulation with DCM, the input stream is broken into groups of *NCBPS*/$N\_{80seg,ru}$ or *NCBPS,u* /$N\_{80seg,ru} $bits ($B\_{0}, B\_{1},…, B\_{N\_{CBPS}/N\_{80seg,ru}}-1$). A group of 4 bits (*B4k, B4k+1, B4k+2, B4k+3*) is 16-QAM modulated to a sample  as described in 17.3.5.8 (Subcarrier modulation mapping). This is the sample on subcarrier *k* in the lower half. In the upper half, the sample $d'\_{k+N\_{SD}/N\_{80seg,ru}}$ on subcarrier $k+N\_{SD}/N\_{80seg,ru }$is obtained by 16-QAM modulating a permutation of the bits (*B4k, B4k+1, B4k+2, B4k+3*). Specifically, $d'\_{k+N\_{SD}/N\_{80seg,ru}}$ is obtained by applying the 16-QAM modulation procedure in 18.3.5.8 to the bit group (*B4k+1*, *B4k*, *B4k+3*, *B4k+2*). The *NSD* here refers to the *NSD* with DCM = 1, which is half the value of *NSD* with DCM = 0.