IEEE P802.11
Wireless LANs

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| 11bd SA2 PHY Comment Resolutions |
| Date: 2022-08-09 |
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Abstract

This submission proposes resolutions for the following six comments received on several PHY subclauses for 802.11bd SA2 ballot:

* 6003, 6010, 6011, 6013, 6014, 6012

Revisions:

* r0: initial version
* r1:
	+ modifications based on comments from teleconference, and
	+ update resolution to CID 6013, and
	+ add resolution to CID 6012

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 6003 |   | 0.00 | Regarding CID #5045, the concern remains. The MIMO technology was introduced to the 802.11 spec in parallel with the 11p (OCB) development. For example, 11p only focused on the 11a waveform then. From the spec time line point of view, it is not clear if OCB can support MIMO. | Suggest adding a subclause or a paragraph to bridge how MIMO works in the OCB environment. For example, as a minimum, need to point out channel measurements while communicating in the OCB. | Revised11bd does not define explicit sounding protocol for OCB MIMO due to the short coherence time in vehicular channels. This is different from 11n/ac/ax SU MIMO. To clarify the OCB MIMO operation, one subclause is proposed to be added. TGbd editor: please make the changes as in <https://mentor.ieee.org/802.11/dcn/22/11-22-1193-02-00bd-11bd-sa2-phy-comment-resolutions.docx> |

*Discussions:*

In Clause 21 (VHT PHY) and 26 (HE PHY) of 802.11REVme 1.3, there is a corresponding subclause describing how a transmitter determines the beamforming matrix based on the channel sounding feedback. For an NGV transmitter, due to the doppler nature of vehicular environment, there is no explicit sounding protocol defined. So the PPDU steering is per each NGV transmitter’s implementation. Add a subclause in similar location in Clause 32 (NGV PHY) to clarify the NGV SU MIMO operation.

*TGbd editor: please add the following subclause after 32.3.9 (Data field) in 11bd D5.0:*

**32.3.9a SU-MIMO**

SU-MIMO is defined for an NGV transmitter to transmit two spatial streams to an NGV receiver to improve throughput.

An NGV transmitter equipped with more than one antenna may use SU-MIMO technique to transmit an NGV PPDU with two spatial streams. The choice of number of spatial streams is described in 31.5 (NGV MAC data service).

The steering matrix , defined in 32.3.7.3 (Transmitted signal), used by the transmitter is implementation specific.

NOTE- the channel in the vehicular environment is fast-varying, so SU-MIMO transmitter can not obtain accurate channel information through sounding. Therefore, there is no explicit sounding protocol defined for an NGV transmitter to obtain the channel information prior to the transmission.

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| 6011 | 32.3.8.3 | 93.24 | "N\_10MHz = 2, If dot11CurrentChannelWidth indicates 20 MHz" means that if the NGV STA is in 20 MHz operating mode, than the L-STF will always be transmitted over 20 MHz. I.e., NGV STA is prohibited from transmitting a 10 MHz NGV PPDU. Same issue for L-LTF, L-SIG, etc. | At P93L22, P94L6, P95L3, change"if dot11CurrentChannelWidth indicates 10 MHz"to"for 10 MHz PPDU"At P93L24, P94L8, P95L5, change"if dot11CurrentChannelWidth indicates 20 MHz"to"for 20 MHz PPDU" | Revised Agree with the commenter that dot11CurrentChannelWidth is an incorrect parameter to determine N\_10MHz. Need to be changed to the parameter that indicates the PPDU BW.TGbd editor: please make the changes as in <https://mentor.ieee.org/802.11/dcn/22/11-22-1193-02-00bd-11bd-sa2-phy-comment-resolutions.docx> |

Discussions:

In 802.11REVme, Clause 32 (HE PHY), the number of subchannels is defined based on TXVECTOR paramter

CH\_BANDWIDTH, which indicates the PPDU bandwidth. For spec consistency, propose to replace dot11CurrentChannelWidth with TXVECTOR parameter CH\_BANDWIDTH.



*TGbd editor: please make the following changes in P93L22 in 11bd D5.0.*

*TGbd editor: please make the following changes in P94L5 in 11bd D5.0.*

 is defined in 32.3.8.3 (L-STF definition)

*TGbd editor: please make the following changes in P95L1 in 11bd D5.0.*

 is defined in 32.3.8.3 (L-STF definition)

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| 6013 | 32.1.1 | 69.44 | DCM (MCS 15) is most useful for 1 SS. In case of 2 SS MCS15, the same data rate can be achieved using 1SS MCS0.Note that 2SS MCS15 is optional in 11ax, and 11be does not support 2SS MCS15 (MCS15 is restricted to 1SS only). | Restrict NGV-MCS 15 to 1SS only (remove NGV-MCS 15 from 2 SS). | RevisedThe original motion on DCM design (Motion #18 in 11-19/0514r14) does not specify the modes. Agree with the commenter that NGV-MCS15 with 2SS is not needed. Remove and modify the corresponding text related to NGV-MCS15 with 2SS.Additionally, notice that two MIBs, *dot11NGVDCMImplemented* and *dot11NGVMidambleRxMaxNSS,* are defined in 11bd to indicate DCM and Midmable support. However, since both features are mandatory for an NGV STA, propose to remove these two MIBs and related text. TGbd editor: please make the changes as in <https://mentor.ieee.org/802.11/dcn/22/11-22-1193-02-00bd-11bd-sa2-phy-comment-resolutions.docx> |

*TGbd editor: please make the following changes in Table 32-22 and Table 32-24 in 11bd D5.0*

Please remove the row of MCS15 in Table 32-22 (NGV-MCSs for 10 MHz, Nss = 2) and add value 15 to value 10-14 as the Reserved entry.

Please remove the row of MCS15 in Table 32-24 (NGV-MCSs for 20 MHz, Nss = 2) and add value 15 to value 10-14 as the Reserved entry.

*TGbd editor: please make the following changes in P125 in 11bd D5.0*

Please remove the two rows corresponding to *dot11NGVDCMImplemented* and *dot11NGVMidambleRxMaxNSS* in Table 32-19 (NGV PHY MIB attributes).

*TGbd editor: please make the following changes in P137L21 and P137L22 in 11bd D5.0.*

Dot11PhyNGVEntry ::= SEQUENCE

{

dot11NGVCurrentChannelWidth INTEGER,

dot11NGVCurrentPrimaryChannel Unsigned32,

dot11NGVCurrentSecondaryChannel Unsigned32,

dot11NGVDYN20MAllowed TruthValue,

}

*TGbd editor: please remove the definition of dot11NGVDCMImplemented and dot11NGVMidambleRxMaxNSS* *from P137L63 to P138L22 in 11bd D5.0.*

*TGbd editor: please make the following changes to B.4.38.2 NGV PHY features in P132L35 to L40 in 11bd D5.0.*

*Replace the row for NGVP2.1 with the following two rows:*

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| NGVP2.1 | NGV-MCS with Index = 0 - 8, or 15 and 10 MHz and NSS = 1 | 32.5(Parametersfor NGVMCSs) | NGVP1.1:M | Yes  No  N/A  |
| NGVP2.1a | NGV-MCS with Index = 0 - 8 and 10 MHz and NSS = 2 | 32.5(Parametersfor NGVMCSs) | NGVP1.1:O | Yes  No  N/A  |

*Replace the row for NGVP2.2 with the following two rows:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NGVP2.2 | NGV-MCS with Index = 0 - 9, or 15 and 20 MHz and NSS = 1 | 32.5(Parametersfor NGVMCSs) | NGVP1.2:M | Yes  No  N/A  |
| NGVP2.2a | NGV-MCS with Index = 0 - 9 and 20 MHz and NSS = 2 | 32.5(Parametersfor NGVMCSs) | NGVP1.2:O | Yes  No  N/A  |

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 6010 | 32.1.1 | 69.45 | Three LTF modes seems like an overkill. | Make NGV-LTF-1x optional. | RejectedEach LTF mode support one operation scenario (e.g. long range mode, normal operation mode, and high efficiency mode). 11bd does not define capability exchange between NGV STAs. To ease the OCB operation, all PHY modes are mandatory, except the modes that are highly tied to hardware capability, e.g. MIMO two spatial streams and 20 MHz support. Additionally, NGV-LTF-1x is similar to HE-LTF-2x, which is also mandatory for 11ax. State-of-art 802.11 device should have no difficulty to support the digital design. |
| 6014 | 32.1.1 | 69.52 | The NGV receiver procedure (P119L18) states that "the receiver \*may\* combine the currently received PPDU with the previously stored NON\_NGV\_10 PPDU". I.e., receivers are not required to combine the PPDUs when receiving repetitive NON\_NGV\_10 PPDUs. | Either \* Move "Repetitive NON\_NGV\_10 PPDU" from P69L52 to P69L65or \* At P69L52, change "Repetitive NON\_NGV\_10 PPDU" to "Transmission of repetitive NON\_NGV\_10 PPDU".Also make corresponding changes at P19L65. | RejectedIt is mandatory for an NGV STA to support both transmit and receive of a Repetitive NON\_NGV\_10 PPDU. An NGV STA can choose the receiving algorithm for a Repetitive NON\_NGV\_10 PPDU, e.g. combine all or some of the repetitive copies in the Repetitive NON\_NGV\_10 PPDU or not to combine. This is implementation choice. For either design, an NGV STA supports the receive of this PPDU format.  |

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| 6012 | 32.3.8.2.1 | 92.39 | The CSD values for pre-NGV modulated fields (P92L39) and NGV modulated fields (P92L54) both simply refer to the values used in VHT.Note that NGV has FFT symbol duration which is twice longer than VHT, and the CSD values in Table 21-10 and 21-11 are in units of nsec.For example, both the VHT and NGV STAs with two transmit antennas are required to use a CSD value of -200 nsec for the pre-VHT/NGV modulated fields for the second transmit chain per Table 21-10.This means that a VHT transmission would have CSD which is 200 nsec / 3200 nsec = 6.25% of the FFT symbol duration (or 25% of the 0.8usec GI), while an NGV transmission would have CSD which is 200 nsec / 6400 nsec = 3.125% of the FFT symbol duration (or 12.5% of the 1.6 usec GI).To have the same order of diversity from CSD between VHT and NGV, the CSD value for NGV should be double that for VHT. | Update 32.3.8.2.1 and 32.3.8.2.2 to state that the CSD value for NGV (for both pre-NGV modulated fields and NGV modulated fields) is twice the values specified in Table 21-10 and 21-11. | RejectedThe commenter raised a good question on the CSD definition for NGV transmissions. There is no need to double the CSD values based on current C2C channel models. See discussions in <https://mentor.ieee.org/802.11/dcn/22/11-22-1193-02-00bd-11bd-sa2-phy-comment-resolutions.docx> |

Discussions:

The longer OFDM symbol and GI duration only means that the allowable maximum CSD value is larger. However, the minimum needed CSD diversity is related to the physical channel delay spread RMS (root mean square). In the analysis below, it is noted that the RMS values for the 802.11n channel models and C2C channel models are in the same order. So by keeping the same CSD table as VHT, NGV provides similar amount of antenna diversity in C2C channels. There is no need to double the CSD values based on current C2C channel models.

The rms values of 802.11n channel models (11-03/940r4) are as below:

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| --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F |
| RMS delay spread (ns) | 0 | 15 | 30 | 50 | 100 | 150 |

The rms values of C2C channel (11-18/858r0) and enhanced C2C channel (11-19/311r1) models are as below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Rural LOS | Urban LOS | Highway LOS | Urban NLOS | Highway NLOS |
| RMS delay spread (ns) | 17.5 | 44.9 | 32.4 | 139 | 175.3 |
|  | Enhanced Rural LOS | Enhanced Urban LOS | Enhanced Highway LOS | Enhanced Urban NLOS | Enhanced Highway NLOS |
| RMS delay spread (ns) | 21.88 | 65.9 | 66.8 | 122.9 | 209.42 |