IEEE P802.11
Wireless LANs

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| LB276 comment resolutions on CIDs related to Rx\_OP\_Gain\_Type and Rx\_OP\_Gain\_Index |
| Date: 2023-10-26 |
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Abstract

This submission proposes resolutions to the following comments submitted in LB276 related to Rx\_OP\_Gain\_Type and Rx\_OP\_Gain\_Index. The CIDs are referring to D2.0. The proposed changes apply to 11bf D2.1.

CIDs: 3300(E), 3335, 3362, 3324(E)

Revision history:

R0: Original version

R1: Add options to resolution of CID 3335

R2: Only keep option 2 to resolution of CID 3335

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| **CID** | **Clause** | **Page** | **Comment** | **Proposed change** | **Proposed resolution** |
| 3300 | 9.4.1.73.3 | 56.21 | The sentence should be moved into Table 9-127h, since the Rx\_OP\_Gain\_Type field is defined and described in that table. | Move the commented sentence into Table 9-127h | **REVISED**Add text “The same type of report is indicated for all receive antennas.” to Table 9-127h. Remove the commented sentence to simplify text. |

**Discussions**:

Agree with the comment and accepted the proposed change in general. The text in “Meaning” (i.e., 4th) column of Rx\_OP\_Gain\_Type entry in Table 9-127h is further revised to avoid repetition.

The text the commenter was referring to:



Remove the commented sentene to avoid repetition, and add the following sentence “The same type of report is indicated for all receive antennas.“ to description of “Rx\_OP\_Gain\_Type” in Table 9-127h as commenter suggested.

**Proposed resolution**: **REVISED**.

**Modifications:**

***To TGbf editor: Please remove the text from P53L29 to P53L31, and insert text in the 4th column on P54L18 as follows.***

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| Rx\_OP\_Gain\_Type  | 2 | Indicates the type of report in Rx\_OP\_Gain\_Index | The same type of report is indicated for all receive antennas.Set to 0 to indicate neither Rx operating point (OP) index nor Rx gain index is reported.Set to 1 to indicate the Rx OP index is reported and the value set in the Rx\_OP\_Gain\_Index field(s) represent an RX OP index mapping.Set to 2 to indicate the Rx gain index is reported and the value set in the Rx\_OP\_Gain\_Index field(s) represent an RF/Analog Gain Index field and a Digital Gain Index field. The value of 3 is reserved. |

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| 3324 | 9.4.1.73.4 | 57.50 | Within the "meaning" column, the condition statements should be "is equal to 1" and so on. | Within the "meaning" column, change "is 1" to "is equal to 1", "is 2" to "is equal to 2" and "is 0 or 3" to "is equal to 0 or 3". There is a similar issue for the first and thrid row of the same table on the next page P58. | **ACCEPTED**Make the same changes as commenter suggested to Meaning field corresponding to following entries in Table 9-127k:Rx\_OP\_Gain\_Index(1)Rx\_OP\_Gain\_Index(2)Rx\_OP\_Gain\_Index(NRx) |

**Proposed resolution**: **ACCEPTED**

**Modifications:**

***To TGbf editor: Please modify the text in the 3rd column of Table 9-127k (******Sensing Measurement Report information*) *on P57L58 as follows.***

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| Rx\_OP\_Gain\_Index(1) | 8 | If the Rx\_OP\_Gain\_Type field is equal to 1, the Rx\_OP\_Gain\_Index(1) field contains the Rx OP index for receive antenna 1.If the Rx\_OP\_Gain\_Type field is equal to 2, the Rx\_OP\_Gain\_Index(1) field contains the Rx gain index for receive antenna 1.If the Rx\_OP\_Gain\_Type field is equal to 0 or 3, the Rx\_OP\_Gain\_Index(1) field is reserved. |
| Rx\_OP\_Gain\_Index(2) | 8 | If the Rx\_OP\_Gain\_Type field is equal to 1, the Rx\_OP\_Gain\_Index(2) field contains the Rx OP index for receive antenna 2.If the Rx\_OP\_Gain\_Type field is equal to 2, the Rx\_OP\_Gain\_Index(2) field contains the Rx gain index for receive antenna 2.If the Rx\_OP\_Gain\_Type field is equal to 0 or 3, the Rx\_OP\_Gain\_Index(2) field is reserved. |
| … | … | … |
| Rx\_OP\_Gain\_Index | 8 | If the Rx\_OP\_Gain\_Type field is equal to 1, the Rx\_OP\_Gain\_Index( ) field contains the Rx OP index for receive antenna.If the Rx\_OP\_Gain\_Type field is equal to 2, the Rx\_OP\_Gain\_Index( ) field contains the Rx gain index for receive antenna.If the Rx\_OP\_Gain\_Type field is equal to 0 or 3, the Rx\_OP\_Gain\_Index( ) field is reserved. |

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| 3335 | 27.22,36.22 | 197.07 | There is currently no RXVECTOR or described source to provide Rx\_OP\_Gain\_Type, or the corresponding Rx\_OP\_Gain\_Index for the MLME SENSREPORT.indication primitive (as referenced in 9.4.1.73). This is the case for both the HE and EHT PHYs. | Either extend the existing CSI\_ESTIMATE description, or define new RXVECTOR to surface data from PHY required to populate Rx\_OP\_Gain\_Type and Rx\_OP\_Gain\_Index fields. | **REVISED**Add seperate RX\_OP\_Gain\_Type and RX\_OP\_Gain\_Index entries in table Table 27-1 and Table 36-1. |

**Proposed resolution**: **REVISED**

Discussion:

RX\_OP\_Gain\_Type and RX\_OP\_Gain\_Index can be added with CSI\_ESTIMATE or as separate entries in table Table 27-1. TGbf group prefers adding them as two entries in Table 27-1 (HE) and Table 36-1 (EHT).

**Modifications:**

***To TGbf editor: Please add the text to Table 27-1 (****TXVECTOR and RXVECTOR parameters) on P198L33* ***as follows.***

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| * TXVECTOR and RXVECTOR parameters
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| Parameter | Condition | Value | TXVECTOR | RXVECTOR |
| CSI\_ESTIMATE | FORMAT is either HE\_SU or HE\_TB, and PSDU\_LENGTH is 0 | Contains an array of CSI values based on the channel measured during the training symbols of the received HE Ranging NDP or HE TB Ranging NDP (see 9.4.1.73.2 (CSI encoding and decoding)). The number of complex elements is , where  is the number of receive antennas,  is the number of transmit antennas, and is the total number of subcarriers (see Table 9-127l (Number of subcarriers as a function of bandwidth, puncturing, and Ng)). | N | Y |
| Otherwise | Not present. | N | N |
| RX\_OP\_Gain\_Type | FORMAT is either HE\_SU or HE\_TB, and PSDU\_LENGTH is 0 | Indicates the type of values contained in Rx\_OP\_Gain\_Index.Set to 0 to indicate neither Rx operating point (OP) index nor Rx gain index is contained in Rx\_OP\_Gain\_Index.Set to 1 to indicate the Rx OP index is contained in Rx\_OP\_Gain\_Index.Set to 2 to indicate the Rx gain index is contained in Rx\_OP\_Gain\_Index.The value of 3 is reserved.See Table 9-127h (Sensing Measurement Report Control field definition)in 9.4.1.73.3 (Sensing Measurement Report Control field)for details. | N | Y |
| Otherwise | Not present. | N | N |
| RX\_OP\_Gain\_Index | FORMAT is either HE\_SU or HE\_TB, and PSDU\_LENGTH is 0 | Contains NRX values indicating Rx operating point index or Rx gain index associated with CSI measurement. See Table 9-127k (Sensing Measurement Report information) in 9.4.1.73.4 Sensing Measurement Report field for details. | N | Y |
| Otherwise | Not present. | N | N |

***To TGbf editor: Please add the text to Table 36-1 (****TXVECTOR and RXVECTOR parameters) on P206L33* ***as follows.***

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| * TXVECTOR and RXVECTOR parameters
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| Parameter | Condition | Value | TXVECTOR | RXVECTOR |
| CSI\_ESTIMATE | FORMAT is EHT\_MU, PSDU\_LENGTH is 0, and CH\_BANDWIDTH is either CBW320-1 or CBW320-2 | Contains an array of CSI values based on the channel measured during the training symbols of the received EHT sounding NDP (see 9.4.1.73.2 (CSI encoding and decoding)). The number of complex elements is , where  is the number of receive antennas,  is the number of transmit antennas, and is the total number of subcarriers (see Table 9-127l (Number of subcarriers as a function of bandwidth, puncturing, and Ng)). | N | Y |
| Otherwise | Not present. | N | N |
| RX\_OP\_Gain\_Type | FORMAT is EHT\_MU, PSDU\_LENGTH is 0, and CH\_BANDWIDTH is either CBW320-1 or CBW320-2 | Indicates the type of values contained in Rx\_OP\_Gain\_Index.Set to 0 to indicate neither Rx operating point (OP) index nor Rx gain index is contained in Rx\_OP\_Gain\_Index.Set to 1 to indicate the Rx OP index is contained in Rx\_OP\_Gain\_Index.Set to 2 to indicate the Rx gain index is contained in Rx\_OP\_Gain\_Index.The value of 3 is reserved.See Table 9-127h (Sensing Measurement Report Control field definition)in 9.4.1.73.3 (Sensing Measurement Report Control field)for details. | N | Y |
| Otherwise | Not present. | N | N |
| RX\_OP\_Gain\_Index | FORMAT is EHT\_MU, PSDU\_LENGTH is 0, and CH\_BANDWIDTH is either CBW320-1 or CBW320-2 | Contains NRX values indicating Rx operating point index or Rx gain index associated with CSI measurement. See Table 9-127k (Sensing Measurement Report information) in 9.4.1.73.4 Sensing Measurement Report field for details. | N | Y |
| Otherwise | Not present. | N | N |

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| 3362 | 9.4.1.73.4 | 66.18 | The Rx OP index indicates the level of impact the sensing receiver operating point has on corresponding CSI estimation". This is extremely vague. "level of impact" can not be quantified. The TG has apparently decided to leave this implementation specific, but this seems unworkable given that at least some common understanding is needed between initiator and responder. | Provide sufficient definition to alow a common understanding or remove from the draft. | **REJECTED**The commentor pointed out the shortcomings of usage of RX\_OP\_Index reporting. The commenter agrees that the RX\_OP\_Index reporting can be used. Agree with the commenter it may be overdesigned in some sense. There is a need to indicate receiver frequency response variation associated with operating point changes. The severity of the problem and solutions have not been fully assessed with complete sensing tests. We think RX\_OP\_Index provides a simple optional solution and recommend to be kept in the draft. |

**Proposed resolution**: REJECTED

* + **Discussion**:

Agree with the commentor that RX\_OP\_Index is implementation specific. The reason is that receiver’s frequency response can vary with changes in operating point, which are associated with BW, temperature, interferences, receiver LNA, VGA, and digital gains. Not only parameters the operating point associated to, but also the frequency response variations are implementation specific. They are very hard to be quantified without complicated and costly PHY level calibrations. One of TG11bf’s goal is to minimize changes at PHY level. But we can not afford to ignore these variations in applications where small CSI variations need to be detected. Practically, a sensing receiver can roughly categorize receiver’ s operating points into a few categories based on product tests.

For example, a vendor founds its receiver filter switches corresponding to a certain range of input signal strength or interference level in a certain BW may cause noticeable frequency response variations, the variations are small enough not to affect regular data communication performance. But such a variation as small as 0.5dB in amplitude may have impact on sensing to detect small CSIs variations. This receiver’s operating point can be categorized into index 0 and 1. The receiver reports a Rx\_OP\_Index value of 0 normally. For this specific filter switch, the receiver reports a Rx\_OP\_Index value of 1 to indicate change from normal frequency response. A vendor can categorize more receiver operating points using Rx\_OP\_Index. Practically this number is very small. When Rx\_OP\_Index is fed back to the sensing initiator, the sensing initiator will be able to tell whether the same sensing receiver’s operating point changes between sensing measurements. Depending on its sensing application needs, the sensing initiator may learn whether it’s beneficial to take this information into consideration. RX\_OP\_Index is optional. If the sensing receive vendor doesn’t have RX\_OP\_Index info, it can also choose not to report it. The Rx\_OP\_Index provides a very simple way for the sensing initiator to get knowledge of sensing receivers frequency response changes.

For the above reasons, Rx\_OP\_Index provides a simple and relatively reasonable solution. We recommend to keep it in 11bf draft unless a more effective method is proposed to solve the receiver frequency response variation indication problem.

The commenter thinks usefulness is limited without the initiator having some understanding of the impact of different indices. Without training, the only practical option may be to not combine measurements with different RX\_OP\_Index values for sensing purposes. This means the index reporting can be used, but appears to be overdesigned.

There is a need to indicate receiver frequency response variation associated with operating point changes. The severity of the problem and solutions have not been fully assessed with complete sensing tests. We think RX\_OP\_Index provides a simple optional solution and recommend to be kept in the draft.

SP:

Do you agree to the resolutions provided for CIDs 3300, 3362, 3335, and 3324 in 23/1845r0 to be included in 11bf Draft 2.1?

Y/N/A