IEEE P802.11
Wireless LANs

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| 802.11 TGac WG Letter Ballot LB187Proposed resolutions to comments onClauses 22.1, 22.2.3, 22.2.4, 22.4.3 |
| Date: 2012-03-07 |
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##### Comments are based on 11ac D2.0. Proposed resolutions are based on 11ac D2.0. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Latex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb

Following CIDs are covered in this document (total 29):

5104, 5472, 5473, 4064, 5105, 5106, 5279, 5283, 4984, 4065, 5292, 5117, 5118, 5119, 5381, 4078, 4198, 5382, 5120, 4212, 4566, 5228, 5322, 5391, 5229, 5230, 4213, 4567, 5392

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5104 | 160.25 | 22.1.1 | number of streams should be maximum number of streams | Replace "number of space-time streams" with "maximum number of space-time streams" |

**Discussion:**

The comment is on the following paragraph:

The VHT PHY extends the number of space-time streams supported to eight and provides support for multi-user (MU) transmissions.

The commenter is correct that eight is the maximum.

**Proposed Resolution:**

ACCEPT.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5472 | 160.40 | 22.1.1 | "convolutional" is not a standard term. It should be "BCC". | Change "convolutional" to "BCC" |

**Discussion:**

The comment is on the following paragraph:

Forward error correction (FEC) coding (convolutional or LDPC) is used with a coding rate of 1/2, 2/3, 3/4, or 5/6.

Note that similar phrase has been used in clauses 18 and 20:

REVmb D12.0: 18.1.1

Forward error correction coding (convolutional coding) is used with a coding rate of 1/2, 2/3, or 3/4.

REVmb D12.0: 20.1.1

Forward error correction (FEC) coding (convolutional coding) is used with a coding rate of 1/2, 2/3, 3/4, or 5/6. LDPC codes are added as an optional feature.

Hence, while it is true that the term BCC is used in many other places in the standard, convolutional coding is also widely used.

**Proposed Resolution:**

REVISE.

Both ‘BCC’ and ‘convolutional coding’ are widely used term in the standard. Also, similar sentences in clauses 18 and 20 uses ‘convolutional coding’. See 11-12/0291r0

**Proposed Text Changes:**

Change P160L40 as follows:

Forward error correction (FEC) coding (convolutional or LDPC coding) is used with a coding rate of 1/2, 2/3, 3/4, or 5/6.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5473 | 160.46 | 22.1.1 | The support to BCC is mandatory should be explicitly stated. | Add a sentence to state that a VHT STA shall support binary convolutional code (BCC). |

**Discussion:**

Commenter is correct that support of BCC is mandatory, as stated in 22.3.10.5.1 (P222L64):

Support for the reception of a BCC encoded Data field is mandatory.

**Proposed Resolution:**

REVISE. See 11-12/0291r0.

**Proposed Text Changes:**

Change P160L47 as follows:

A VHT STA shall support:

* 20 MHz, 40 MHz and 80 MHz channel widths
* Single spatial stream MCSs 0 to 7 (transmit and receive) in all supported channel widths
* Binary convolutional coding

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4064 | 160.55 | 22.1.1 | "Initiate transmit beamforming sounding (by sending an NDPA frame followed by a VHT NDPframe)"This is not a PHY characteristic. Relate to PHY properties only in the PHY clause. | Replace with: "Support beamforming sounding (by sending a VHT NDP frame)" |

**Discussion:**

Initiating transmit beamforming sounding by sending an NDPA is done by MAC.

**Proposed Resolution:**

REVISE. See 11-12/0291r0.

**Proposed Text Changes:**

Change P160L55 as follows:

A VHT STA may optionally support:

* 2 or more spatial streams (transmit and receive)
* 400 ns short guard interval (transmit and receive)
* Beamforming sounding (by sending a VHT NDP frame)

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5105 | 161.01 | 22.1.1 | Unclear intent | What is the meaning of "when operating with appropriate N\_SS and channel width"?Please clarify. |

**Discussion:**

The comment is on:

A VHT STA may optionally support:

…

* MCSs 8 and 9 (transmit and receive) when operating with appropriate *NSS* and channel width

Tables 22-29 to 22-60 shows that MCS9 is not valid for certain combinations of Nss and channel width, which was the intent of the phrase above. However, this is an introductory subclause, and it is understood that further details would be given in subsequent subclauses. For example, MCS6 is not valid for 80 MHz, Nss=3, but the draft does not call out this level of detail.

**Proposed Resolution:**

REVISE. See 11-12/0291r0.

**Proposed Text Changes:**

Change P161L1 as follows:

A VHT STA may optionally support:

…

* MCSs 8 and 9 (transmit and receive)

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5106 | 161.26 | 22.1.3.1 | Insert "physical" before "layer management" | Change "layer management funtion" to "physical layer management funtion" |

**Discussion:**

The comment is on:

The VHT PHY contains three functional entities: the PHY convergence function (i.e., the PLCP), the PMD function, and the layer management function (i.e., the PLME).

The commenter is correct that the layer management function referred to hear is the layer management function for PHY. However, searching through REVmb D12.0, there are no instances of “physical layer management function”. Furthermore there are several locations in REVmb D12.0 which simply refers to “the layer management function.”

REVmb D12.0 P411L26:



REVmb D12.0 P1573L43:



REVmb D12.0 P1654L54:



REVmb D12.0 P1740L12:



So, while the commenter is correct that the layer management function is for PHY, the term “the layer management function” seems to be a commonly used term in the existing baseline.

**Proposed Resolution:**

REJECT. Baseline standard uses the term “the layer management function” throughout the document.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5279 | 161.44 | 22.1.3.3 | The VHT PMD sublayer provides a means to send and receive data between two or more STAs. This clause is concerned with the below 6 GHz frequency bands excluding the 2.4 GHz frequency band using OFDM modulation as described in 22.3 (VHT PLCP sublayer). --> the 11ah and 11af bands should be excluded also from below 6 GHz | Clarify which bands are excluded |
| 5283 | 161.45 | 22.1.3.3 | "below 6 GHz frequency bands excluding the 2.4 GHz frequency band." Should we just say "5 GHz band"? | As in comment |

**Discussion:**

The comment is on:

The VHT PMD sublayer provides a means to send and receive data between two or more STAs. This clause is concerned with the below 6 GHz frequency bands excluding the 2.4 GHz frequency band using OFDM modulation as described in 22.3 (VHT PLCP sublayer).

It is clear from Annex E that the 11ac draft currently targets operation in 5 GHz only. Rather than leaving the frequency band addressed by 11ac open ended, it would be cleaner to specify which bands are addressed by the 11ac amendment specifically. If other 802.11 amendments wishes to enable 11ac in other frequency bands, that amendment could add the specific frequency band to the list at the time.

As another data point, Clause 20 (REVmb D12.0, 20.1.3.3) clearly states that the clause is for 2.4 GHz and 5 GHz frequency bands.



**Proposed Resolution:**

CID 5279:

DUPLICATE of CID 5283.

CDI 5283:

REVISE. See 11-12/0291r0.

**Proposed Text Changes:**

Change P161L45 as follows:

This clause is concerned with the 5 GHz frequency bands using OFDM modulation as described in 22.3 (VHT PLCP sublayer).

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4984 | 162.17 | 22.1.4 | what purpose does adding HT\_GF as an option serve? Unless I've missed it, I couldn't find in the comment spread sheet any comments related to HT\_GF. | Remove the optional HT\_GF |

**Discussion:**

As stated in 22.2.4.1, a VHT STA logically contains Clause 18, Clause 20 and Clause 22 PHYs. Hence, VHT transmitter may transmit an HT-greenfield format PPDU if it chooses to do so. In order to support this mode of transmission, the FORMAT parameter for a VHT should include the HT\_GF.

**Proposed Resolution:**

REJECT. A VHT STA is an HT STA, and thus could choose to transmit an HT\_GF format PPDU.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4065 | 162.26 | 22.1.4 | "The legacy part of the preamble"No no no no no. Any part of the 802.11 standard has equal merit to any other part, including currently the 802.11a OFDM PHY. A part of the standard cannot describe another part of itself as legacy, which implies that the 802.11a PHY is being superseded by VHT. From the standard point of view, that is not the case. | Replace with "The parts of the VHT preamble preceding the VHT-SIG-A field" |

**Discussion:**

The term ‘legacy’ is often vague, thus should be avoided whenever possible. In Clause 22, L-STF, L-LTF and L-SIG in a VHT preamble are referred to as “non-VHT portion of VHT format preamble” (see the title of 22.3.8.1).

**Proposed Resolution:**

REVISE. See 11-12/0291r0.

**Proposed Text Changes:**

Change P162L26 as follows:

The non-VHT portion of the VHT format preamble (the parts of VHT preamble preceding the VHT-SIG-A field) is defined so that it can be decoded by these STAs.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5292 | 171.18 | 22.2.3 | "If the bandwidth of theVHT BSS is wider than 40 MHz, then the transmission shall use the primary40 MHz channel." Something wrong in this sentence. Is says wider than 40MHz but then it is 40MHz. There are 3-4 more instances of similar wording in this table. | Maybe it should be: "If the supported bandwidth of the VHT BSS.." |
| 5117 | 171.31 | 22.2.3 | Add NON\_HT modulation to first column of Table 22-2 where appropriate | When using CBW40, the first coumn should read "Format is NON\_HT and NON\_HT\_MODULATION is NON\_HT\_DUP\_OFDM".Same applies for subsequent rows of Table 22-2. |

**Discussion:**

**CID 5292:**



CH\_BANDWIDTH = CBW40 refers to the bandwidth of the PPDU being transmitted, while the bandwidth of the VHT BSS refers to the maximum bandwidth usable in the BSS. Note that the exact terminology for the BSS BW is “BSS operating channel width”:

TGac D2.0, 8.4.2.161 (VHT Operation element), P72L19:



TGac D2.0, 10.38.1 (Basic VHT BSS functionality), P140L28:



Hence, we should use “BSS operating channel width” to avoid further confusion.

**CID 5117:**

Context: Table 22-2



(CBW80, CBW60, CBW80+80 not copied here for simplicity.)

The way to interprete Table 22-2 is the following:

* If FORMAT = NON\_HT and CH\_BANDWIDTH = CBW20, *then* NON\_HT\_MODULATION = OFDM.
* If FORMAT = NON\_HT and CH\_BANDWIDTH = CBW20/40/80/160/80+80, *then* NON\_HT\_MODULATION = NON\_HT\_DUP\_OFDM.

This is seen by the fact that the PPDU format column of Table 22-2 specifies whether to use the Clause 18 format or subclause 22.3.10.12.

**Proposed Resolution:**

**CID 5292:**

REVISE. See 11-12/0291r0.

**CID 5117:**

REVISE. See 11-12/0291r0.

**Proposed Text Changes:**

Change Table 22-2 on P171 as follows:

**Table 22-2 – PPDU format as a function of CH\_BANDWIDTH parameter**

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| **FORMAT** | **CH\_BANDWIDTH** | **PPDU format** |
| VHT, HT\_MF or HT\_GF | CBW20 | The STA transmits an HT-mixed (when format is HT\_MF) or HT-greenfield format PPDU (when format is HT\_GF) or VHT format PPDU (when format is VHT) of 20 MHz bandwidth. If the BSS operating channel width (#5292) is wider than 20 MHz, then the transmission shall use the primary 20 MHz channel. |
| VHT, HT\_MF or HT\_GF | CBW40 | The STA transmits an HT-mixed (when format is HT\_MF) or HT-greenfield format PPDU (when format is HT\_GF) or VHT format PPDU (when format is VHT) of 40 MHz bandwidth. If the BSS operating channel width (#5292) is wider than 40 MHz, then the transmission shall use the primary 40 MHz channel. |
| VHT | CBW80 | The STA transmits a VHT format PPDU of 80 MHz bandwidth. If the BSS operating channel width (#5292) is wider than 80 MHz, then the transmission shall use the primary 80 MHz channel. |
|  |  |  |
| NON\_HT | CBW20 | The STA transmits a NON\_HT format PPDU with NON\_HT\_MODULATION set to OFDM (#5117) using the primary 20 MHz channel according to Clause 18 operation (#5117). |
| NON\_HT | CBW40 | The STA transmits a NON\_HT format PPDU with NON\_HT\_MODULATION set to NON\_HT\_DUP\_OFDM using (#5117) two adjacent 20 MHz channels as defined in 22.3.10.12 (Non-HT duplicate transmission). If the BSS operating channel width (#5292) is wider than 40 MHz, then the transmission shall use the primary 40 MHz channel. The one 20 MHz channel higher in frequency is rotated +90º relative to the 20 MHz channel lowest in frequency as defined in Equation (26). |
| NON\_HT | CBW80 | The STA transmits a NON\_HT format PPDU with NON\_HT\_MODULATION set to NON\_HT\_DUP\_OFDM using (#5117) four adjacent 20 MHz channels as defined in 22.3.10.12 (Non-HT duplicate transmission). If the BSS operating channel width (#5292) is wider than 80 MHz, then the transmission shall use the primary 80 MHz channel. The three 20 MHz channels higher in frequency are rotated +180º relative to the 20 MHz channel lowest in frequency as defined in Equation (27). |
| NON\_HT | CBW160 | The STA transmits a NON\_HT format PPDU with NON\_HT\_MODULATION set to NON\_HT\_DUP\_OFDM using (#5117) eight adjacent 20 MHz channels as defined in 22.3.10.12 (Non-HT duplicate transmission). The second, third, fourth, sixth, seventh, eighth 20 MHz channels in the order of increasing frequency are rotated +180º relative to the 20 MHz channel lowest in frequency as defined in Equation (28). |
| NON\_HT | CBW80+80 | The STA transmits a NON\_HT format PPDU with NON\_HT\_MODULATION set to NON\_HT\_DUP\_OFDM using (#5117) two non-adjacent frequency segments, with each frequency segment consisting of four adjacent 20 MHz channels as defined in 22.3.10.12 (Non-HT duplicate transmission). In each frequency segment, the three 20 MHz channels higher in frequency are rotated +180º relative to the 20 MHz channel lowest in frequency as defined in Equation (27). |

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5118 | 173.12 | 22.2.4.2 | Wrong reference | The Figure reference Clause 19 and Clause 17. This should be Clause 20 and Clause 18 respectively |

**Discussion:**

Figure 22-1:



Note that 19.3.20.4 (Transmit center frequency tolerance) should be changed to 20.3.20.7.2 (Transmit center frequency leakage).

**Proposed Resolution:**

REVISE. Change P173L12 ‘Clause 19 PHY-TXSTART.req’ to ‘Clause 20 PHY-TXSTART.req’. Change P173L12 ‘Clause 17 PHY-TXSTART.req’ to ‘Clause 18 PHY-TXSTART.req’. Change P173L18 ’19.3.20.4’ to ’20.3.20.7.2’. Change P173L18 ’17.3.9.7.2’ to ’18.3.9.7.2’. See 11-12/0291r0 for exact location of changes.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5119 | 173.58 | 22.2.4.2 | Split Figure 22-1 | Figure 22-1 Captures three different interactions. It will be clearer to split this figure in three parts, each with their own caption. Especially since description of the figure is already somewhat limited in the text. |

**Discussion:**

Context: Figure 22-1.



While there seems to be nothing technically wrong with splitting Figure 22-1 into three, there does not seem to be benefit from doing so either. Figure 22-1 is referenced only once, and it does not call out the three different parts of the figure separately.

**Proposed Resolution:**

REJECT. There does not seem to be benefit in splitting the figure.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5381 | 174.55 | 22.2.4.3 | Definition of CH\_OFFSET\_ABOVE and CH\_OFFSET\_BELOW has been interchanged. | Change "CH\_OFFSET\_ABOVE if f\_{P20,idx} > f\_{S20,idx}" to "CH\_OFFSET\_ABOVE if f\_{P20,idx} < f\_{S20,idx}". Also, change "CH\_OFFSET\_BELOW if f\_{P20,idx} < f\_{S20,idx}" to "CH\_OFFSET\_BELOW if f\_{P20,idx} > f\_{S20,idx}" |

**Discussion:**

Context:



From REVmb D12.0 P413L53:



Hence, secondary 20 MHz channel center frequency (f\_{S20,idx}) should be greater than the primary 20 MHz channel centery frequency (f\_{P20,idx}) for CH\_OFFSET\_ABOVE.

**Proposed Resolution:**

ACCEPT.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4078 | 174.57 | 22.2.4.3 | "The quantities f\_P20,idx and f\_S20,idx are defined in 22.2.3 (Effects of CH\_BANDWIDTH parameter on PPDU format)."Methinks this is not so. I had a rummage around in 22.2.3 and didn't find them. | Add a definition of these to 22.2.3. |
| 4198 | 174.57 | 22.2.4.3 | Introduce a definition of f\_P20,idx and f\_S20,idx or rewrite the paragraph, because the following is not true anymore: "Thequantities and are defined in 22.2.3 (Effects of CH\_BANDWIDTH parameter on PPDU for-mat)." | As in comment |
| 5382 | 174.57 | 22.2.4.3 | f\_P20,idx and f\_S20,idx are defined in 22.3.7. | Change "... are defined in 22.2.3" to "... are defined in 22.3.7." |
| 5120 | 174.58 | 22.2.4.3 | Wrong reference | Reference to 22.2.3 is wrong.Please correct. |

**Discussion:**

The definition of f\_P20,idx and f\_S20,idx have been moved to 22.7.3.

P192L33:



P192L45:



P193L6:



**Proposed Resolution:**

**CID 5382:**

ACCEPT.

**CID 4078, 4198, 5120:**

DUPLICATE of CID 5382.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4212 | 271.41 | 22.4.3 | In the TXTIME computation for short GI, T\_SYM should be replaced by T\_SYML. This computation seems to be taken from the 11n spec, but 11ac introduced T\_SYML, so this equation needs to be updated. | Change T\_SYM to T\_SYML in the short GI equation of TXTIME. |
| 4566 | 271.41 | 22.4.3 | I think there is an error in TXTIME for short GI in Eq. 22-119. TXTIME is a function of T\_SYM. In Table 22-5, T\_SYM for short GI is T\_SYMS. Replacing T\_SYMS for T\_SYM in Eq. 22-119 cancels out the T\_SYM in the denominator in the ceiling function. It also makes the multiplication in front of the ceiling function incorrect. Keeping the definition for T\_SYM in Table 22-5 unchanged, I think Eq. 22-119 needs to be changed such that the two occurrences of T\_SYM are replaced by T\_SYML. | In Eq. 22-119 change two occurrences of T\_SYM with T\_SYML. |
| 5228 | 271.41 | 22.4.3 | T\_SYM should be replace with T\_SYML | T\_SYM has been redefined to be either T\_SYMS or T\_SYML (see Table 22-5, last row on page 189) depending of shortGI setting. In the case of equation (119), this would mean T\_SYM is T\_SYMS. This is not the desired outcome.T\_SYM should be replaced with T\_SYML. |
| 5322 | 271.41 | 22.4.3 | Eq (119) is for short GI frames. So according to Table 22-5, TSYML should be used instead of TSYM as TSYM in this context means short GI. | Replace TSYM with TSYML in Eq (119). |
| 5391 | 271.41 | 22.4.3 | T\_SYM should be changed to T\_SYML in equation (119). Otherwise, T\_SYMS/T\_SYM=1. | Change "T\_SYM" to "T\_SYML" in two places in Equation (119). To be consistent in notation, Change "T\_SYM" to "T\_SYML" in one place in Equation (120) as well. Also, change "T\_SYM" to "T\_SYML" in one place on P271L60. |

**Discussion:**

Context:



In case of transmissions using short GI, T\_SYM = T\_SYMS, thus equation (119) is technically incorrect. As stated in all the comments above, T\_SYM in equation (119) should be replaced by T\_SYML.

To be consistent in notation, T\_SYM in equation (120) should be changed to T\_SYML. P271L60 should also be updated accordingly.

**Proposed Resolution:**

**CID 5391:**

ACCEPT. (See 11-12/0291r0 for the exact location of the four places where T\_SYM has to be replaced.)

**CID 4212, 4566, 5228, 5322:**

DUPLICATE of CID 5391.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5229 | 271.53 | 22.4.3 | Terminology | Replace "non-HT preamble" with "non-HT Training Field" (see e.g. Table 22-4) |
| 5230 | 271.56 | 22.4.3 | Terminology | Replace "VHT preamble" with "VHT Training Field" (see e.g. Table 22-4) |

**Discussion:**

Context:



An equation would suffice to define T\_LEG\_PREAMBLE and T\_VHT\_PREAMBLE clearly.

**Proposed Resolution:**

REVISE. See 11-12/0291r0.

**Proposed Text Change:**

Change P271L53 as follows:

*T*LEG\_PREAMBLE = *T*L-STF + *T*L-LTF

*T*VHT\_PREAMBLE *= T*VHT-STF + *NVHTLTF T*VHT-LTF

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4213 | 272.10 | 22.4.3 | Is LENGTH specified? | Please clarify. Probably it should be changed to "APEP\_LENGTH". |
| 4567 | 272.10 | 22.4.3 | LENGTH in Eq 121 should be APEP\_LENGTH | Change LENGTH in Eq 121 to APEP\_LENGTH |
| 5392 | 272.10 | 22.4.3 | "LENGTH" should be "APEP\_LENGTH". | Change "LENGTH" to "APEP\_LENGTH". |

**Discussion:**

Context:



The comments are correct that APEP\_LENGTH is the correct variable to use for N\_SYM computation.



Similar equations to compute N\_SYM for LDPC coding also uses APEP\_LENGTH.

D2.0 P224L7



D2.0 P224L50



**Proposed Resolution:**

**CID 4567:**

ACCEPT.

**CID 4213, 5392:**

DUPLICATE of CID 4567.