IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | SA1 PHY CR Part 2 | | | | | | Date: 2020-06-23 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Youhan Kim | Qualcomm |  |  | youhank@qti.qualcomm.com | |

Abstract

This submission proposes resolutions for the following comments from the SA1 on P802.11ax D6.0:

24191, 24192, 24291, 24414, 24415, 24416, 24477, 24205, 24206, 24327

NOTE – Set the Track Changes Viewing Option in the MS Word to “All Markup” to clearly see the proposed text edits.

**Revision History:**

R0: Initial version.

R1: Updated during TGax call on 6/16/2020

R2: Updated resolutions per offline discussion

CID 24194: Added updates to Figures 27-55 and 27-60.

CID 24414: Added a NOTE to further clarify the units.

CID 24327: Fixed typo in heading of proposed text update (was saying CID 24206 instead of 24327).

# CID 24191

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24191 | 571.15 | 27.3.11.7.4 | "HE-SIG-A2 has the same encoded bits as HE-SIG-A1". The use of HE-SIG-A1, HE-SIG-A2, ... is ambiguous. In Table 27-18 and 27-20, the terms HE-SIG-A1 and HE-SIG-A2 are used to indicate different bits. Here, it appears they're referring more to OFDM symbols and do not correspond to the definition used in those tables. | Improve wording and make use of HE-SIG-A1, HE-SIG-A2, ... consistent with Tables 27-18 and 27-20. |

**Proposed Resolution: CID 24191**

**Revised**

Note to Commenter:

HE-SIG-A1/A2/A3/A4 are changed to HE-SIG-A1/A1-R/A2/A2-R in this proposed resolution.

Instruction to Editor:

Implement the text changes for CID 24191 in <https://mentor.ieee.org/802.11/dcn/20/11-20-0894-02-00ax-sa1-phy-cr-part-2.docx>.

**Proposed Text Update: CID 24191**

*Instruction to Editor: Update D6.1 P536L53 as shown below.*

For an HE ER SU PPDU, the HE-SIG-A field consists of four parts, HE-SIG-A1, HE-SIG-A1-R, HE-SIG-A2 and HE-SIG-A2-R. HE-SIG-A1 and HE-SIG-A1-R have the same data bits while HE-SIG-A2 and HE-SIG-A2-R have the same data bits as defined in 27.3.11.7 (HE-SIG-A).

1. Obtain the HE-SIG-A fields from the TXVECTOR. Add the reserved bits, append the calculated CRC, and then append the Ntail tail bits as shown in 27.3.11.7 (HE-SIG-A). This results in 52 uncoded bits.
2. BCC encoder: Encode the data by a convolutional encoder at the rate of R = 1/2 as described in 17.3.5.6 (Convolutional encoder).
3. BCC interleaver: Interleave the data bits of HE-SIG-A1 and HE-SIG-A2 as described in 27.3.12.8 (BCC interleavers). The data bits of HE-SIG-A1-R and HE-SIG-A2-R are not interleaved.
4. Constellation mapper: BPSK modulate the HE-SIG-A1, HE-SIG-A2, and HE-SIG-A2-R data bits as described in 17.3.5.8 (Subcarrier modulation mapping) to form the first, third, and fourth OFDM symbol of HE-SIG-A, respectively. QBPSK modulate the HE-SIG-A1-R encoded data bits to form the second OFDM symbol of HE-SIG-A.

*Instruction to Editor: Update Table 27-18 at D6.1 P560L41 as shown below.*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * HE-SIG-A field of an HE SU PPDU and HE ER SU PPDU | | | | | | | | | |
| Two Parts of HE-SIG-A | | Bit | | Field | | Number of bits | | Description | |
| HE-SIG-A2 | | B0-B6 | | TXOP | | 7 | | Set to 127 to indicate no duration information if TXVECTOR parameter TXOP\_DURATION is set to UNSPECIFIED.  Set to a value less than 127 to indicate duration information for NAV setting and protection of the TXOP as follows:  If TXVECTOR parameter TXOP\_DURATION is less than 512, then B0 is set to 0 and B1-B6 is set to floor(TXOP\_DURATION/8).  Otherwise, B0 is set to 1 and B1-B6 is set to floor((TXOP\_DURATION – 512) / 128).  where  B0 indicates the TXOP length granularity. Set to 0 for 8 µs; otherwise set to 1 for 128 µs.  B1-B6 indicates the scaled value of the TXOP\_DURATION | |

*Instruction to Editor: Update D6.1 P574L11 (and Figure 27-25) as shown below.*

For an HE ER SU PPDU, the HE-SIG-A field is composed of four parts, i.e. HE-SIG-A1, HE-SIG-A1-R, HE-SIG-A2and HE-SIG-A2-R, each part containing 26 data bits. These four parts are transmitted sequentially from HE-SIG-A1 to HE-SIG-A2-R. The data bits of HE-SIG-A1 and HE-SIG-A2 shall be BCC encoded at rate, *R* = 1/2, interleaved, mapped to a BPSK constellation, and have pilots inserted. HE-SIG-A1-R has the same encoded bits as HE-SIG-A1 and the encoded bits shall be mapped to a QBPSK constellation without interleaving and have pilots inserted. The constellation mappings of the HE-SIG-A field in an HE ER SU PPDU is shown in Figure 27-25. The QBPSK constellation on HE-SIG-A1-R is used to differentiate between an HE ER SU PPDU and an HE MU PPDU when *m* = 1 in Equation (27-11). HE-SIG-A2-R has the same encoded bits as HE-SIG-A2 and the encoded bits shall be mapped to a BPSK constellation without interleaving and have pilots inserted. BCC encoding, data interleaving, constellation mapping and pilot insertion follow the steps described in 17.3.5.6 (Convolutional encoder), 27.3.12.8 (BCC interleaver), 17.3.5.8 (Subcarrier modulation mapping), and 17.3.5.9 (Pilot subcarriers), respectively.

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| Figure 27-25 - Data subcarrier constellation of HE-SIG-A symbols |



*Instruction to Editor: Update Figure 27-55 at D6.1 P669L1 as shown below.*

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**Figure 27-55—PHY transmit procedure for an HE ER SU PPDU**



*Instruction to Editor: Update Figure 27-58 at D6.1 P672L30 as shown below.*



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| Figure 27-58 – PHY transmit state machine for an HE PPDU without midambles |



*Instruction to Editor: Update Figure 27-60 at D6.1 P673L41 as shown below.*



**Figure 27-60—PHY receive procedure for an HE ER SU PPDU**



# CID 24192

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24192 | 571.47 | 27.3.11.7.4 | Figure 27-25 shows modulated constellation points. It may be better to not refer to these as "HE-SIG-A1" etc. Instead use something like "Symbol 1", "Symbol 2", ... | See comment |

**Background**

From resolution to CID 24191:

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| Figure 27-25 - Data subcarrier constellation of HE-SIG-A symbols |

**Proposed Resolution: CID 24192**

**Rejected**

The purpose of Figure 27-25 is to illustrate that different HE-SIG-A symbols have different constellation mapping. Labeling them as a more generic ‘symbol 1’, ‘symbol 2’ will make it harder to understand what ‘symbol X’ means.

# CID 24291

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24291 | 640.29 | 27.3.15.2 | Various places assume an HE TB PPDU is sent in response to a Trigger frame, but this is not true for MU-RTS | In the referenced subclause change "Each STA that is scheduled in a triggering frame" to "Each STA that is scheduled to transmit an HE TB PPDU" |

**Proposed Resolution: CID 24291**

**Revised**

Note to Commenter:

Instruction to Editor below updates “scheduled in a triggering/Trigger frame” to more appropriate phrases in 27.3.15.

Instruction to Editor:

At D6.1 P643L29, change “triggering frame calculates” to “triggering frame to transmit an HE TB PPDU calculates”.

At D6.1 P644L14, delete “that is scheduled in a Trigger frame”.

**FYI - Proposed Text Update in Red Line: CID 24291**

27.3.15 Transmit requirements for PPDUs sent in response to a triggering frame

27.3.15.2 Power pre-correction

Each STA that is scheduled in a triggering frame to transmit an HE TB PPDU calculates the UL transmit power, , of the HE TB PPDU for the assigned HE-MCS using Equation (27-124).

* 

where

*PLDL* represents DL pathloss

*TargetRSSI* represents the target receive signal power of the HE TB PPDU averaged over the AP’s antenna connectors. *TargetRSSI* is the value, in dBm, indicated in the UL Target RSSI subfield of User Info field in Trigger frame or the TRS control field.

NOTE—A value of 127 in the UL Target RSSI subfield indicates that the HE TB PPDU is transmitted at its maximum transmit power for the assigned HE-MCS, and Equation (27-124) is not used.

Each STA computes *PLDL* using Equation (27-125).



where

 is in dBm and represents the AP’s transmission power and is equal to the value of the AP Tx Power subfield of the Common Info field in the Trigger frame, the encoding of which is specified in 9.3.1.22 (Trigger frame format) or the DL Tx Power subfield of the TRS Control field as specified in 9.2.4.6a.1 (TRS Control).

*DLRSSI* represents the RSSI at the antenna connector(s) of the STA of the triggering PPDU normalized to 20 MHz bandwidth. *DLRSSI* in dBm is an average of the received power over the antennas on which the average *PLDL* is being computed. If the triggering PPDU is a HT-mixed, VHT or HE PPDU, then the received power is measured from the fields prior to the HT-STF, VHT-STF or HE-STF, respectively.

NOTE—An AP could account for its beamforming gain in  or *TargetRSSI* if the triggering PPDU used beamforming.

A STA that applies beamforming (BF) in the UL should take the BF gain into account when calculating the transmit power needed to meet the target RSSI.

The UL transmit power of the HE TB PPDU is further subject to a STA’s minimum and maximum transmit power limit due to hardware capability, regulatory requirements and local maximum transmit power levels (see 11.8.5 (Specification of regulatory and local maximum transmit power levels)) as well as non-802.11 in-device coexistence requirements.

A STA includes its UL power headroom in the HE TB PPDU following the rules defined in 26.5.2.3 (Non-AP STA behavior for UL MU operation).

# CID 24414, 24415, 24416

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24414 | 640.66 | 27.3.15.2 | [Resubmission of comment withdrawn on D5.0] Re CID 20521. The clarification I suggested that  NOTE---Tx\_^AP\_pwr is in units of dBm / 20 MHz; DL\_RSSI is in implementation-defined units; Target\_RSSI is in dBm. Equations (27-124) and (27-125) need to take account of the differing units.  be added was missed | Insert the cited text after the "where" explanation for Equation (27-125). Also at line 54 change "is in dBm" to "is in dBm / 20 MHz" |
| 24415 |  |  | [Resubmission of comment withdrawn on D5.0] Re CIDs 20521, 20522. "normalized to 20 MHz bandwidth" is less clear than saying it's "in dBm per 20 MHz bandwidth" | Change  "normalized to 20 MHz bandwidth"  to  "in units of dBm per 20 MHz bandwidth"  in  9.2.4.6a.1 TRS Control, 9.3.1.22.1 General,  27.3.15.2 Power pre-correction.  In 26.10.3.4 UL Spatial Reuse subfield of Trigger frame change "is in dBm per 20 MHz bandwidth".  In 9.2.4.6a.1 TRS Control, 9.3.1.22.1 General  delete  ",in units of dBm,"  in  "The AP Tx Power subfield indicates, in units of dBm," |
| 24416 |  |  | [Resubmission of comment withdrawn on D5.0] Re CIDs 20521, 20522. "normalized to 20 MHz bandwidth" is less clear than  saying it's "in dBm per 20 MHz bandwidth" | Use the "value in dBm normalized to a 20 MHz bandwidth (i.e.,  minus transmit bandwidth divided by 20 MHz bandwidth in dB)" formulation used in 26.10.3.2/4 for all 3 instances of "normalized to 20 MHz" |

**Proposed Resolution: CID 24414**

**Revised**

Note to Commenter:

Regarding changing “dBm” to “dBm / 20 MHz”: Instruction to editor below implements this change with some editorial changes.

Regarding the addition of NOTE:

Note that PL\_{DL} computed in Equation (27-125) is ‘unit-less’ – yes, it is in ‘dB’ but that just means that we are using ‘10\*log10()’. In other words, both Tx\_{pwr}^{AP} and DL\_{RSSI} are ‘power’ in dBm (log of Watts), but PL\_{DL} is the log of ‘ratio’ of the two variables, hence the ratio has no ‘unit’ in terms of power.

Since the link between Equation (27-124) and (27-125) is PL\_{DL} which has no unit, the fact that the two equations may use different units (for other variables) is immaterial. Anyway, a NOTE is added to remind readers of the different units.

Instruction to Editor:

Implement the text changes for CID 24414, 24415, 24416 in <https://mentor.ieee.org/802.11/dcn/20/11-20-0894-02-00ax-sa1-phy-cr-part-2.docx>.

**Proposed Resolution: CID 24415**

**Revised**

Note to Commenter:

Instruction to editor below implements the spirit of the comment. Note that this CID 24415 suggests using the term “dBm per 20 MHz bandwidth” while CID 24414 from the same commenter suggests using the term “dBm / 20 MHz”. The latter is chosen in this resolution.

Also, the commenter’s instruction ‘In 26.10.3.4 UL Spatial Reuse subfield of Trigger frame change "is in dBm per 20 MHz bandwidth"’ is not clear. Nevertheless, some editorial changes have been made in the spirit of the comment.

Instruction to Editor:

Implement the text changes for CID 24414, 24415, 24416 in <https://mentor.ieee.org/802.11/dcn/20/11-20-0894-02-00ax-sa1-phy-cr-part-2.docx>

**Proposed Resolution: CID 24416**

**Revised**

Note to Commenter:

The term “dBm / 20 MHz” is used instead as proposed by the same commenter in CID 24414.

Instruction to Editor:

Implement the text changes for CID 24414, 24415, 24416 in <https://mentor.ieee.org/802.11/dcn/20/11-20-0894-02-00ax-sa1-phy-cr-part-2.docx>

**Proposed Text Updates: CID 24414, 24415, 24416**

9.2.4.6a.1 TRS Control

*Instruction to Editor: Update D6.1 P91L9 as shown below.*

The AP Tx Power subfield indicates the AP’s combined transmit power at the antenna connectors of all the transmit antennas used to transmit the triggering PPDU in units of dBm / 20 MHz. The transmit power, *PTX*, is calculated as *PTX* = –20 + 2×*FVal*, where *FVal* is the value of the AP Tx Power subfield, except for the value 31, which is reserved.

9.3.1.22 Trigger frame format

9.3.1.22.1 General

*Instruction to Editor: Update D6.1 P122L19 as shown below.*

The AP Tx Power subfield of the Common Info field indicates the AP’s combined transmit power at the antenna connectors of all the transmit antennas used to transmit the Trigger frame in units of dBm / 20 MHz. The transmit power is reported with a resolution of 1 dB, with values in the range 0 to 60 representing –20 dBm / 20 MHz to 40 dBm / 20 MHz, respectively. Values above 60 are reserved.

26.10.3.2 PSR-based spatial reuse initiation

*Instruction to Editor: Update D6.1 P427L9 as shown below.*

* An PSRT PPDU is queued for transmission and the intended transmit power of the PSRT PPDU in dBm / 20 MHz is below the value of PSR minus RPL, where PSR is the value obtained from Table 27-23 (Spatial Reuse field encoding for an HE TB PPDU) based on at least one of:

26.10.3.4 UL Spatial Reuse subfield of Trigger frame

*Instruction to Editor: Update D6.1 P428L33 as shown below.*

*TX\_PWRAP* is the total power at the antenna connector(s), in dBm / 20 MHz, over all antennas used to transmit the PSRR PPDU containing the Trigger frame for each 20 MHz transmit bandwidth for 20 MHz, 40 MHz, and 80 MHz PPDU or in each of the 40 MHz transmit bandwidths for an 80+80 MHz or 160 MHz PPDU.

Acceptable Receiver Interference LevelAP is a value in dBm / 20 MHz for each 20 MHz transmit bandwidth for 20 MHz, 40 MHz, and 80 MHz PPDU or in each of the 40 MHz transmit bandwidths for an 80+80 MHz or 160 MHz PPDU and should be set to value of the UL target RSSI indicated in the Trigger frame minus the minimum SNR value that yields ≤ 10% PER for the highest HE-MCS of the ensuing uplink HE TB PPDU, minus a safety margin value not to exceed 5 dB as determined by the AP.

27.3.15.2 Power pre-correction

*Instruction to Editor: Update D6.1 P643L54 as shown below.*

 represents the AP’s transmission power in units of dBm / 20 MHz and is equal to the value of the AP Tx Power subfield of the Common Info field in the Trigger frame, the encoding of which is specified in 9.3.1.22 (Trigger frame format) or the DL Tx Power subfield of the TRS Control field as specified in 9.2.4.6a.1 (TRS Control).

*DLRSSI* represents the RSSI at the antenna connector(s) of the STA of the triggering PPDU in units of dBm / 20 MHz. *DLRSSI* is an average of the received power over the antennas on which the average *PLDL* is being computed. If the triggering PPDU is a HT-mixed, VHT or HE PPDU, then the received power is measured from the fields prior to the HT-STF, VHT-STF or HE-STF, respectively.

NOTE—An AP could account for its beamforming gain in or *TargetRSSI* if the triggering PPDU used beamforming.

NOTE 2 -  and are in units of dBm / 20 MHz, while  and  are in units of dBm.

# CID 24477

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24477 | 641.01 | 27.3.15.2 | "NOTE--An AP could account for its beamforming gain in Tx^AP\_pwr or TargetRSSI if the triggering PPDU used beamform- ing." needs to be stronger | Change to "An AP shall account for its beamforming gain in Tx^AP\_pwr or TargetRSSI if the triggering PPDU is beamformed." |

**Background**

D6.1 P643-644 (27.3.15.2 Power pre-correction)

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**Proposed Resolution: CID 24477**

**Rejected**

Whether the AP accounts its beamforming gain in Tx\_pwr^AP or Target\_RSSI does not have any impact to STA’s operation. It only affects the signal level at which the UL signal arrives at the AP. For example, if the AP had 3 dB beamforming gain which it did not ‘account for’, then all users would arrive 3 dB stronger than ‘indicated’ in the Trigger frame. But to many AP receiver implementations, that may not matter as the relative signal level between different users may be more critical. Hence, a NOTE is more appropriate here than a normative statement.

# CID 24205

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24205 | 641.23 | 27.3.15.3 | "A STA transmitting at and above the minimum power shall support the EVM requirements for HE-MCS 7." This essentially means the STA has to meet the MCS 7 requirements at any power above the minimum? This is contradicted by the definition of P just above. | Delete "and above" |

**Background**

D6.1 P644

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**Proposed Resolution: CID 24205**

**Revised**

Note to Commenter:

Instruction to Editor below clarifies the TX power range for which the HE-MCS7 EVM is required to be met.

Instruction to Editor:

Implement the text changes for CID 24205 in <https://mentor.ieee.org/802.11/dcn/20/11-20-0894-02-00ax-sa1-phy-cr-part-2.docx>.

**Proposed Text Update: CID 24205**

*Instruction to Editor: Update D6.1 P644L24 as shown below.*

A STA transmitting at and above the minimum power, but below *P*max,MCS7, shall support the EVM requirements for HE-MCS 7, where *P*max,MCS7 is the maximum transmit power supported by the STA for HE-MCS 7 in an HE TB PPDU.

# CID 24206

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24206 | 650.25 | 27.3.19.1 | Figure 27-53: what happens to the mask beyond N x 10? | Clarify. |

**Proposed Resolution: CID 24206**

**Revised**

Note to Commenter:

Instruction to Editor below updates the example to the case of an 80 MHz HE PPDU with the upper most 20 MHz subchannel punctured, and updates Figure 27-53 accordinly.

Instruction to Editor:

Implement the text changes for CID 24206 in [https://mentor.ieee.org/802.11/dcn/20/11-20-0862-03-00ax-sa1-phy-cr.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-0862-02-00ax-sa1-phy-cr.docx).

**Proposed Text Updates: CID 24206**

*Instruction to Editor: Update D6.1 P653L1 as shown below.*

An example transmit spectral mask for an 80 MHz HE PPDU with the highest 20 MHz subchannel punctured is shown in Figure 27-53.



**Figure 27-53— Example transmit spectral mask for an 80 MHz HE PPDU with the highest 20 MHz subchannel punctured**



# CID 24327

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| **CID** | **Page.Line** | **Clause** | **Comment** | **Proposed Change** |
| 24327 |  | 27 | "left" and "right" are not well-defined for frequencies; the correct terminology is "lower", "higher". LTF\_left, for example, looks suspect (a similar comment on the baseline has been submitted for REVmd/D3.0) | Fix in Table 27-13--Subcarrier allocation related constants for the HE-modulated fields in a non- OFDMA HE PPDU and 27.3.11.10 HE-LTF |

**Background**

D6.1 P543

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D6.1 P604

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Similar comment on VHT-LTF (left, right) was submitted by the commeter to REVmd (CID 4544 on REVmd D3.0), and has been resolved as follows (<https://mentor.ieee.org/802.11/dcn/19/11-19-2156-11-000m-revmd-sponsor-ballot-comments.xls>).

|  |
| --- |
| (Motion 175)  REJECTED (PHY: 2020-04-08 21:04:10Z) -  LTF\_left and LTF\_right are intermediate variables used to define VHT-LTF. The usage of LTF\_left and LTF\_right is clear in the standard (e.g. see Equation (21-36)), and thus there is no technical issue with the terms. |

**Proposed Resolution: CID 24327**

**Revised**

Note to Commenter:

Regarding N\_Guard,left and N\_Guard,right, those variables are not used anywhere in 11ax D6.1. So, the instruction to editor below deletes those variables from Table 27-13.

Regarding LTF\_\*left\* and LTF\_\*right\*, they are intermediate variables used to define the overall LTF sequences. The usage of LTF\_\*left\* and LTF\_\*right\* are clear in 27.3.11.10 (HE-LTF), and thus there is no technical issue with the terms. Furthermore, 27.3.11.10 constructs LTF\_\*lower\* and LTF\_\*upper\* based on LTF\_\*left\* and LTF\_\*right\*, hence renaming ‘left/right’ to ‘lower/higher’ will cause collision of variable names and cause confusion to readers.

Instruction to Editor:

Delete the rows corresponding to N\_{Guard,left} and N\_{Guard,right} in Table 27-13 at D6.1 P543L34.

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