IEEE P802.11
Wireless LANs

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| Comment resolutions for QoS Control |
| Date: 2019-03-01 |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D4.0 with the following CIDs (18 CIDs):

* 20459, 20460, 20461, 20462, 20463, 20572, 20672, 20717, 20734, 20907,
* 20908, 21123, 21452, 21465, 21453, 20532, 21346, 21347

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Removed 3 deferred CIDs (20672, 20717, 21123). No changes to the technical content.
* Rev 2: Resolved the 3 deferred CIDs and addressed comments received offline by several members. Added to the list of resolved comments CID 20532, 21346, and 21347 since they are related to buffer status report. Changes are highlighted in green.
* Rev 3: Incorporated suggestions that were received during the presentation at the ad-hoc. This revision also fixes the issues related to the 3 CIDs that were deferred during the ad-hoc. These changes are highlighted in this color.

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 20459 | Mark RISON | 71.62 | "The Queue Size subfield is an 8-bit field that indicates the amount of buffered traffic for a given TC or TS at the non-HE non-AP STA sending the frame that contains this subfield and the amount of buffered traffic at the non-AP STA for transmission to the HE AP identified by the receiver address of the frame that contains this subfield." is misleading. The Queue Size is always for a given TC or TS, not for all queues | Change the cited text at the referenced location to "The Queue Size subfield is an 8-bit field that indicates the amount of buffered traffic for a given TC or TS at the non-HE non-AP STA sending the frame that contains this subfield and the amount of buffered traffic for a given TC or TS at the HE non-AP STA for transmission to the HE AP identified by the receiver address of the frame that contains this subfield." | Revised –Agree with the comment. Proposed resolution accounts for the suggested change. TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20459. |
| 20460 | Mark RISON | 72.23 | The Queue Size, to be useful, needs to include traffic queued above the MAC SAP | At the end of the referenced paragraph add "The queue size may include MSDUs buffered above the MAC SAP." | Rejected –The comment fails to identify a technical issue. The queue size is an 8-bit long field that provides the amount of buffered traffic for a given TC or TS (the buffered traffic accounts for buffered MSDUs), not the MSDU themselves buffered above the MAC SAP. |
| 20461 | Mark RISON | 72.28 | The Queue Size subfield should not be specified three times. One for rx and one for tx is sufficient | Delete from "The Queue Size subfield contains:" to "A value of 255 to indicate a queue size that is unspecified or unknown" inclusive in the referenced subclause and replace with "The Queue Size subfield contains a UV subfield in the 6 LSBs and a SF subfield in the 2 MSBs." | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested change although we maintain the description related to the UV and SF subfields since their definitions are needed for the table. The Queue Size subfield encoding is now provided as a table that summarizes all the settings. TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20461. |
| 20462 | Mark RISON | 72.50 | Equation (9-0a) is not correct when the QS is >= 254 | Change the referenced line to "148 480 + 32 768 x UV, if the SF subfield is 3 and the UV subfield is < 62", append two lines "> 2 147 328 if the Queue Size subfield is 254" and "unspecified or unknown if the Queue Size subfield is 255" and delete the NOTE immediately following | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested changes. TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20462. |
| 20463 | Mark RISON | 72.56 | The encoding should be expressed as equations, not prose | At the referenced location change "The transmitter rounds the actual queue size using the following procedure:" to "An HE non-AP STA sets the Queue Size subfield or its UV and SF subfields as follows:". Change the first two bullets to "Else if QS <= 1008, UV = ceil( QS / 16 ) and SF = 0", the next two to "Else if QS <= 17 152, UV = ceil( (QS - 1024) / 256 and SF = 1", the next two to "Else if QS <= 146 432, UV = ceil ( (QS - 17 408) / 2048 ) and SF = 2", the next two to "Else if QS <= 2 147 328, UV = ceil( (QS - 148 480) / 32 768 ) and SF = 3" (where in all cases ceil( <x> ) is to be replaced by the ceiling symbols, - is to be replaced by the minus glyph and <= is to be replaced by the <= glyph), and append a new bullet "Else the Queue Size subfield is set to 254" and prepend at the start of the list a new bullet "If QS is unspecified or unknown, the Queue Size subfield is set to 255" | Revised –Agree in principle with the comment. Proposed resolution removes this paragraph and instead provides a table with the encoding of the Queue Size subfiedls depending on the QS at the STA, inline with the current encoding.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20463. |
| 20572 | Mark RISON | 72.01 | "The Queue Size subfield is present in QoS Data frames and, for non-AP HE STAs, in QoS Nullframes sent by non-AP STAs with bit 4 of the QoS Control field equal to 1." -- this is duplication, and inaccurate duplication at that (see Table 9-10---QoS Control field) | Delete the cited text at the referenced location | Revised –It is beneficial to have this explicitly stated in the Queue Size subfield since only HE non-AP STAs can use QoS Null frames to provide queue size in the QoS Control field, whole non-HE non-AP STAs cannot. In the baseline this sublause mentions only the QoS Data frames, which is not the only frame carrying the Queue Size for HE STAs, as mentioned above. Also, reviewing Table 9-10, the CRC could not identify the inaccuracy of the statements. Please identify the inaccuracy and submit a new comment or point the inaccuracy by some other means. Proposed resolution is to clarify that QoS Data frames are the ones carrying the Queue Size for non-HE STAs and additionally the QoS null frames for HE STAs. TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20572. |
| 20672 | Mark RISON | 71.57 | "If sent by a non-HE STA or sent to a non-HE STA, the following apply: [...] If sent by a non-AP HE STA to an HE AP, the remainder of the subclause applies." -- this leaves undefined the cases of transmission to a peer HE TDLS STA or HE IBSS STA or HE mesh STA | As it says in the comment | Revised –Agree in principle with the comment. Proposed resolution clarifies that the Queue Size subfield is reserved if sent by a non-AP HE STA to another non-AP HE STA.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20672. |
| 20717 | Mark RISON | 72.23 | Re CID 16001: the point is that there needs to be clarity as to what "buffered at the STA" means | At 72.27 add a "NOTE---Buffered MSDUs are those that have been received in an MA-UNITDATA.request but that have not been successfully transmitted." | Revised –Agree in principle with the comment although it should already be clear what buffered MSDUs mean at the MAC layer. But a note does not hurt. Proposed resolution accounts for the suggested change.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20717. |
| 20734 | Mark RISON | 71.57 | Re CID 16078: the rejection is incorrect. The TID is passed as the Priority in the MA-UNITDATA.request | At the end of the referenced subclause add "NOTE---The Queue Size is based on data received by the STA at the MAC SAP (MA-UNITDATA.request). Any data in layers above the MAC is not taken into account." | Revised –Agree in principle with the comment although it should be already clear that the queue size is based on data received by the STA at the MAC SAP. But again, a note does not hurt. Proposed resolution accounts for the suggested change. The CRC believes that it is unnecessary to mention whether data in layers above the MAC are considered. TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20734. |
| 20907 | Mark RISON | 72.24 | "including the MSDUs or A-MSDUs of the present MPDU or A-MPDU" makes no sense | Change to "including the MSDUs or A-MSDUs in the same PSDU as the MPDU containing the Queue Size subfield" | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested change.  TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20907. |
| 20908 | Mark RISON | 72.24 | Re CID 16077: the proposed change was to exclude the current MSDU, to match the non-HE case | Change "including the MSDUs or A-MSDUs of the present MPDU or A-MPDU" at 72.24 to "excluding the MSDUs or A-MSDUs in the same PSDU as the MPDU containing the Queue Size subfield". Change "including the MSDUsor A-MSDUs in the same PSDU as the MPDU containing the BSR Control subfield" at 84.7 to "excluding the MSDUs or A-MSDUs in the same PSDU as the MPDU containing the BSR Control subfield" | Rejected –The comment fails to identify a technical issue. The legacy case was designed when MPDUs were not aggregated as such the rule was excluding the MSDUs or A-MSDUs. In 11ax the MPDUs are mainly aggregated as such the rule “including the MSDU or A-MSDU” is beneficial because the recipient of the QoS Control field can discount the MSDUs or A-MSDUs that are successfully received in the A-MPDU. With the earlier rule this would not be possible, and the recipient would not know of any of the lost frames in the received A-MPDU. |
| 21123 | Pascal VIGER | 71.62 | The section has been modified and misses one case for HE STA: "The Queue Size subfield...indicates.. the amount of buffered traffic at the non-AP STA for transmission to the HE AP identified by the receiver address of the frame that contains this subfield." The case of HE STA transmitting to HE STA (direct traffic or P2P) is now missing.For information, BSR already handles that :"Queue Size High subfield indicates the amount of buffered traffic...that is intended for the STA identified by the receive address of the framecontaining the BSR Control subfield".So destination of legacy 'Queue Size' format report has to be amended. | Modify the sentence by replacing to the "HE AP" by "to the HE STA" (in that case, both non-AP and AP cases are supported).Final sentence becomes: "...the amount of buffered traffic at the non-AP STA for transmission to the HE STA identified by the receiver address of the frame that contains this subfield." | Revised –Agree in principle with the comment. Proposed resolution clarifies that the Queue Size subfield is used when sent by a non-AP HE STA to another HE STA. Also provided some more clarifications as to what STA sends these QoS Control fields by editorially reorganizing the sentence in question.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 21123. |
| 21452 | Tomoko Adachi | 73.17 | Considering a case when some fragments are carried in A-MPDU 1 and others are carried in A-MPDU 2, can the queue size value of the MPDUs in A-MPDU 2 be the same with that of the MPDUs in A-MPDU 1 even if the amount of queued traffic changes as successive fragments are transmitted? | Clarify. | Revised –Agree in principle with the comment that the statement is not clear. The proposed resolution is to refer to the subclauses that define the normative behavior for both cases (10.24.3.5.1, and 10.13.1). And explicitly call out that these MPDUs are QoS Data (that contain fragments) and not refer to non-A-MPDU, S-MPDU or the likes since the normative rules in the respective subclauses are already clear in this aspect.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 21452. |
| 21465 | Wookbong Lee | 72.31 | Would it be possible to show in a diagram the SF and UV in a table/diagram | As suggested in the comment | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested change. The Queue Size subfield encoding is now provided as a table that summarizes all the settings. TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 21465. |
| 21453 | Tomoko Adachi | 84.15 | Considering a case when some fragments are carried in A-MPDU 1 and others are carried in A-MPDU 2, can the queue size value of the MPDUs in A-MPDU 2 be the same with that of the MPDUs in A-MPDU 1 even if the amount of queued traffic changes as successive fragments are transmitted? | Clarify. | Revised –Agree in principle with the comment that the statement is not clear. The proposed resolution is to refer to the subclauses that define the normative behavior for both cases (10.24.3.5.1, and 10.8). And explicitly call out that these MPDUs are QoS Data (that contain fragments) and not refer to non-A-MPDU, S-MPDU or the likes since the normative rules in the respective subclauses are already clear in this aspect.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 21453. |
| 20532 | Mark RISON | 83.07 | Some Delta TID values are ambiguous, e.g. for 3 bits set in ACI Bitmap, if Delta TID indicates 4 or 5 TIDs, it is not clear which TIDs are being reported on | In Table 9-24d, embolden "Value 1 indicates 3 TIDs", "Value 1 indicates 4 TIDs", "Value 2 indicates 5 TIDs", "Value 1 indicates 5 TIDs", "Value 2 indicates 6 TIDs", "Value 3 indicates 7 TIDs" and add to the end of the table note "For the combinations shown in bold, it is not possible for the AP to determine which TIDs the STA is reporting buffer status for." | Revised –The Delta TID is used to indicate to the AP from how many TIDs the STA has data available in its buffers, not which TIDs. The number of TIDs is used then by the AP to set the TID Aggregation Limit in the User Info field addressed to the STA to an appropriate value. Added a note to clarify this point.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 20532. |
| 21346 | Robert Stacey | 340.03 | In 9.2.4.5.6 and 9.2.4.6a.4 the term queue size is used (and defined). But this subclause uses the undefined term buffer status report. | Align the terminology. Change the 1st sentence to "A non-AP STA reports its queue size to assist the AP in allocating UL MU resources." In the remainder of the paragraph, "BSR" becomes "queue size". Change "reports its buffer status (unsolicited BSR)" at 340.13 to "reports its queue size" Change remaning "buffer status" to "queue size" | Revised –Agree in principle with the comment. Buffer status report, depending on which field is used, refers in general to the queue size for a given TID if in QoS Control field, and to the set of parameters ACI bitmap, Delta TID, AC High, two queue sizes if in BSR Control field. Proposed resolution adds this definition and replaces the buffer status with queue size when it refers explicitly to the queue size contents.TGax editor to make the changes shown in 11-19/0303r3 under all headings that include CID 21346. |
| 21347 | Robert Stacey | 340.13 | It's not "either-or". It's mandatorially QoS Control and optionally BSR Control. | "A non-AP STA reports its queue size in the QoS Control field and BSR Control subfields of a QoS Data frame or QoS Null frame as follows:" | Revised –Agree in principle with the comment. This item is resolved as part of comment resolutions incorporated in D4.1 inline with the comment, except that the BSR Control can also be present in Management frams. *Note to TGax Editor: The change below is already present in D4.1. Hence no further changes are necessary.*TGax editor: Replace “A non-AP STA reports its buffer status (unsolicited BSR) to the AP to which it is associated using either the QoS Control field or the BSR Control subfield of frames it transmits as defined below” with “A non-AP STA reports its buffer status (unsolicited BSR) to the AP to which it is associated in the QoS Control field in QoS Null and QoS Data frames and in the BSR Control subfield (if present) in QoS Null, QoS Data and Management frames as defined below”. |

**Discussion: *None.***

* QoS Control field
* Queue Size subfield

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 20459, 20572, 21123):***

The Queue Size subfield is an 8-bit field that indicates the amount of buffered traffic for a given TC or TS at the non-HE non-AP STA sending the frame that contains this subfield and the amount of buffered traffic for a given TC or TS at the HE non-AP STA for transmission to the HE STA identified by the receiver address of the frame that contains this subfield. The Queue Size subfield is present in QoS Data frames with bit 4 of the QoS Control field equal to 1 sent by non-AP STAs andin QoS Null frames with bit 4 of the QoS Control field equal to 1 sent by non-AP HE STAs. The AP might use information contained in the Queue Size subfield to determine the TXOP duration assigned to the STA or to determine the UL resources assigned to the non-AP HE STA (see 26.5.3 (UL MU operation)).*(#20459, 20572, 21123)* (#16232)

If sent by a non-HE STA or sent to a non-HE STA, the following apply:

* The queue size value is the approximate total size, rounded up to the nearest multiple of 256 octets and expressed in units of 256 octets, of all MSDUs and A-MSDUs buffered at the STA (excluding the MSDU or A-MSDU of the present QoS Data frame) in the delivery queue used for MSDUs and A-MSDUs with TID values equal to the value in the TID subfield of this QoS Control field.
* A queue size value of 0 is used solely to indicate the absence of any buffered traffic in the queue used for the specified TID.
* A queue size value of 254 is used for all sizes greater than 64 768 octets.
* A queue size value of 255 is used to indicate an unspecified or unknown size.

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 20672, 21123):***

If sent by a non-AP HE STA to an HE STA, the remainder of the subclause applies.*(#20672, 21123)*

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 20717, 20734, 20907):***

The queue size, *QS*, is the approximate total size in octets, of all MSDUs and A-MSDUs buffered at the STA (including the MSDUs or A-MSDUs in the same PSDU as the MPDU containing the Queue Size subfield(#16077)) in the delivery queue used for MSDUs and A-MSDUs with TID values equal to the value in the TID subfield of this QoS Control field.

NOTE 1—The queue size is based on data received by the STA at the MAC SAP (MA-UNITDATA.request).

NOTE 2—Buffered MSDUs are those that have been received in an MA-UNITDATA.request but that have not been successfully transmitted and have not been discarded.*(#20717, 20734, 20907)* (#15963)

**TGax Editor: *Change the paragraph below and insert a new table as follows (#CID 20461, 20463, 21465):***

 The Queue Size subfield consists of a Scaling Factor subfield in the 2 MSBs (bits 14-15) of the QoS Control subfield and an unscaled value, *UV*, in the bits 8-13 of the QoS Control subfield. The Scaling Factor subfield provides the scaling factor, *SF*, with an encoding that is shown in Table 9-24e (Scaling Factor subfield encoding). A non-AP HE STA sets the Queue Size subfield in a QoS frame it transmits as shown in Table 9-X (Queue Size subfield encoding by a non-AP HE STA).

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| Table 9-X -- Queue Size subfield encoding by a non-AP HE STA |
| Queue Size, *QS* | Queue Size subfields | Description |
| Scaling Factor | UV |
| 0 | 0 | 0 | No buffered traffic in the queue used for the specified TID |
| 0 < *QS* ≤ 1 008 | 0 | Ceil (*QS*, 16) / 16 | The queue size is in units of 16 octets |
| 1 008 < *QS* ≤ 1 024 | 1 | 0 | The queue size is between 1 009 and 1 024 octets |
| 1 024 < *QS* ≤ 17 152 | 1 | Ceil (*QS* – 1 024, 256) / 256 | The queue size is in units of 256 octets |
| 17 152 < *QS* ≤ 17 408 | 2 | 0 | The queue size is between 17 152 and 17 408 octets |
| 17 408 < *QS* ≤ 146 432 | 2 | Ceil (*Q*S – 17 408, 2 048) / 2 048 | The queue size is in units of 2 048 octets |
| 146 432 < *QS* ≤ 148 480 | 3 | 0 | The queue size is between 146 432 and 148 480 octets |
| 148 480 < *QS* ≤ 2 147 328 | 3 | Ceil (*QS* – 148 480, 32 768) / 32 768 | The queue size is in units of 32 768 octets |
| *QS* > 2 147 328 | 3 | 62 | The queue size greater than 2 147 328 |
| Unspecified/Unknown | 3 | 63 | The queue size is unspecified or unknown |

*(#20461, 20463, 21465)*

**TGax Editor: *Change the paragraph below and insert a new table as follows (#CID 20462, 20672, 21123):***

An HE STA*(#20672, 21123)* obtains the queue size, *QS*, from a received QoS Control field, which contains a scaling factor and an unscaled value, as follows:

*

*Q*

*S*

16

*U*

*V*



if the Scaling Factor subfield is 0



1024

256

*U*

*V*



+

if the Scaling Factor subfield is 1



17 408

2048

*U*

*V*



+

if the Scaling Factor subfield is 2



148 480

> 2 147 328 if the Scaling Factor subfield is 3 and UV subfield is 62

Unspecified or unknown if the Scaling Factor subfield is 3 and UV subfield is 63

32 768

*U*

*V*



+

if the Scaling Factor subfield is 3 and UV subfield is < 62

















=

*(#20462)* (#15963)

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 20463):***

* (#15861, #15960, #15963)*(#20463)*

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 21452):***

The queue size value of QoS Data frames containing fragments might remain constant in all fragments even if the amount of queued traffic changes as successive fragments are transmitted (see 10.24.3.5.1 (General)). If the QoS Data frames containing fragments are carried in an A-MPDU, the queue size values of the QoS Data frames containing containing the fragments are set according to the rules in 10.13.1 (A-MPDU contents). *(#21452)* (#16912, #16911)

* BSR Control

If the Control ID subfield in a Control subfield in an A-Control subfield is 3, the Control Information subfield of the Control subfield contains buffer status information used for UL MU operation (see 26.5.3.6 (HE buffer status feedback operation for UL MU)). The format of the subfield is shown in Figure 9-22e (Control Information subfield for BSR Control).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0            B3 | B4         B5 | B6        B7 | B8        B9 | B10    B17 | B18    B25 |
|  | ACI Bitmap | Delta TID | ACI High | Scaling Factor | Queue Size High | Queue Size All |
| Bits: | 4 | 2 | 2 | 2 | 8 | 8 |
| * Control Information subfield for BSR Control
 |

The ACI Bitmap subfield indicates the access categories for which the buffer status is reported and its encoding is shown in Table 9-24c (ACI Bitmap subfield encoding). Each bit of the ACI Bitmap subfield is set to 1 to indicate the buffer status of the corresponding AC, and set to 0 otherwise. If(#15202) the ACI Bitmap subfield is 0 and the Delta TID subfield is 3 it indicates that there is buffered traffic for all 8 TIDs (see Table 9-24d (Delta TID subfield encoding)).

|  |
| --- |
| * ACI Bitmap subfield encoding
 |
| B0 | B1 | B2 | B3 |
| AC\_BE | AC\_BK | AC\_VI | AC\_VO |

The Delta TID subfield, together with the values of the ACI Bitmap subfield, indicate the number of TIDs for which the STA is reporting the buffer status. The encoding of the Delta TID subfield is defined in Table 9-24d (Delta TID subfield encoding).

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 20532):***

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| * Delta TID subfield encoding
 |
| Number of bits in the ACI Bitmap subfield that are set to 1 | Mapping of Delta TID subfield value and number of TIDs, *NTID* |
| 0 | Values 0 to 2 are not applicable;Value 3 indicates 8 TIDs (i.e., all ACs have traffic) |
| 1 | Value 0 indicates 1 TID; Value 1 indicates 2 TIDs;Values 2 to 3 are not applicable; |
| 2 | Value 0 indicates 2 TID; Value 1 indicates 3 TIDs;Value 2 indicates 4 TIDs; Value 3 is not applicable; |
| 3 | Value 0 indicates 3 TID; Value 1 indicates 4 TIDs;Value 2 indicates 5 TIDs; Value 3 indicates 6 TIDs; |
| 4 | Value 0 indicates 4 TID; Value 1 indicates 5 TIDs;Value 2 indicates 6 TIDs; Value 3 indicates 7 TIDs; |
| NOTE 1—The number of TIDs can be obtained as *NTID* = *Nones* + *DVal*, where *Nones* is the number of bits set to one in the AC Bitmap subfield, and *DVal* is the value of the Delta TID subfield except if(#15203) *Nones* is equal to 0 for which there is the *NTID* = 8 case.NOTE 2—The Delta TID might be used by an AP to determine the setting of the TID Aggregation Limit field in the User Info field addressed to the STA in a subsequent Basic Trigger frame.*(#20532)* |

The ACI High subfield indicates the ACI of the AC for which the BSR is indicated in the Queue Size High subfield. The ACI to AC mapping is shown in Table 9-24c (ACI Bitmap subfield encoding).

NOTE—It is up to the non-AP STA that reports the buffer status to determine which queue deserves higher priority with respect to the other queues. The determination might be based on the time the traffic has been outstanding, QoS delay requirements, amount of buffered traffic, etc., and is out of scope for this standard.

The Scaling Factor subfield indicates the unit *SF*, in octets, of the Queue Size High and Queue Size All subfields. The encoding of the Scaling Factor subfield is shown in Table 9-24e (Scaling Factor subfield encoding).

|  |
| --- |
| * Scaling Factor subfield encoding
 |
| Scaling Factor subfield | Scaling factor, *SF,* in octets |
| 0 | 16 |
| 1 | 256 |
| 2 | 2 048 |
| 3 | 32 768 |

The Queue Size High subfield indicates the amount of buffered traffic, in units of *SF* octets, for the AC identified by the ACI High subfield that is intended for the STA identified by the receive address of the frame containing the BSR Control subfield.

The Queue Size All subfield indicates the amount of buffered traffic, in units of *SF* octets, for all the ACs identified by the ACI Bitmap subfield that is intended for the STA identified by the receive address of the frame containing the BSR Control subfield.

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 20717, 20734, 20907):***

The queue size values in the Queue Size High and Queue Size All subfields are the total sizes, rounded up to the nearest multiple of *SF* octets, of all MSDUs and A-MSDUs buffered at the STA (including the MSDUs or A-MSDUs in the same PSDU as the MPDU containing the BSR Control subfield) in the delivery queues used for MSDUs and A-MSDUs with AC(s) that are specified in the ACI High and ACI Bitmap subfields, respectively.

NOTE 1—The queue size is based on data received by the STA at the MAC SAP (MA-UNITDATA.request). Any data in layers above the MAC is not taken into account.

NOTE 2—Buffered MSDUs are those that have been received in an MA-UNITDATA.request but that have not been successfully transmitted and have not been discarded.*(#20717, 20734, 20907)*

A queue size value of 254 in the Queue Size High and Queue Size All subfields indicates that the amount of buffered traffic is greater than 254 ×*SF* octets.(#15866) A queue size value of 255 in the Queue Size High and Queue Size All subfields indicates that the amount of buffered traffic is an unspecified or unknown size.(#15866)

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 21453):***

The queue size value of QoS Data frames containing the fragments might remain constant in all fragments even if the amount of queued traffic changes as successive fragments are transmitted (see 10.24.3.5.1 (General)).(#16913) If the QoS Data frames containing fragments are carried in the A-MPDU, the queue size values of the QoS Data frames containing the fragments are set according to the rules in 10.8 (HT Control field operation).*(#21453)* (#16914)

* Buffer status report operation

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 21346):***

A non-AP STA delivers buffer status reports (BSRs) to assist its AP in allocating UL MU resources. The non-AP STA can either implicitly deliver BSRs in the QoS Control field or BSR Control subfield of any frame transmitted to the AP (unsolicited BSR) or explicitly deliver BSRs in any frame sent to the AP in response to a BSRP Trigger frame (solicited BSR). The buffer status reported in the QoS Control field consists of a queue size value for a given TID (see 9.2.4.5.6 (QoS Control field). The buffer status reported in the BSR Control field consists of an ACI bitmap, delta TID, a high priority AC, and two queue sizes (see 9.2.4.6a.4 (BSR Control)).*(#21346)*

An HE STA shall set the BSR Support subfield of the HE Capabilities element it transmits to 1 if dot11HEBSRControlImplemented is true; otherwise the HE STA shall set the BSR Support subfield to 0.

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 21346, 21347):***

A non-AP STA reports its buffer status (unsolicited BSR) to the AP to which it is associated in the QoS Control field in QoS Null and QoS Data frames and in the BSR Control subfield (if present) in QoS Null, QoS Data and Management frames as defined below:(#21343)*(#21347)*

* The HE STA shall report the queue size*(#21346)* for a given TID in the Queue Size subfield of the QoS Control field in QoS Data or QoS Null frames it transmits; the STA may set the Queue Size subfield to 255 to indicate an unknown/unspecified queue size*(#21346)* for that TID.
* The HE STA may aggregate multiple QoS Data frames or QoS Null frames in an A-MPDU to report the queue size*(#21346)* for different TIDs. The HE STA shall follow the A-MPDU aggregation rules defined in 26.6.4 (Multi-TID A-MPDU and ack-enabled A-MPDU) for aggregating QoS Data frames with multiple TIDs. The HE STA does not follow the rules defined in 26.6.4 (Multi-TID A-MPDU and ack-enabled A-MPDU) for QoS Null frames whose Ack Policy subfield is No Ack.
* The HE STA may report the buffer status in the BSR Control subfield of frames it transmits if the AP has indicated its support in the BSR Support subfield of its HE Capabilities element; otherwise the STA shall not report the buffer status in the BSR Control subfield.
* The HE STA shall report the queue size*(#21346)* for its preferred AC, indicated by the ACI High subfield, in the Queue Size High subfield of the BSR Control subfield; the STA may set the Queue Size High subfield to 255 to indicate an unknown/unspecified queue size*(#21346)* for that AC.
* The HE STA shall report the queue size*(#21346)* for the(#20530) ACs, indicated by the ACI Bitmap subfield, in the Queue Size All subfield of the BSR Control subfield; the STA may set the Queue Size All subfield to 255 to indicate an unknown/unspecified queue size*(#21346)* for those ACs.
* The HE STA shall set the Delta TID subfield according to Table 9-24d (Delta TID subfield encoding), and the Scaling Factor subfield as defined in 9.2.4.6a.4 (BSR Control).

NOTE 1—The STA can send an unsolicited BSR in response to certain Trigger frames except MU-RTS and BSRP (with or without RA-RUs, as defined in 26.5.2.3 (Non-AP STA behavior for UL MU operation) and in 26.5.4 (UL OFDMA-based random access (UORA))) or it can send the unsolicited BSR after accessing the WM using EDCA.

NOTE 2—The STA might include a BSR Control subfield in a QoS Data or QoS Null frame. In this case the Queue Size subfield in the QoS Control field and the Queue Size High and Queue Size All subfields(#Ed) in the BSR Control subfield might differ, and either or both might be 255 to indicate unspecified or unknown queue size*(#21346)*. The STA might include only the BSR Control subfield in a Management frame.(#20495, #21345)

An AP can also solicit one or more associated non-AP STAs for their BSR(s) by sending a BSRP Trigger frame (see 9.3.1.22.6 (Buffer Status Report Poll (BSRP) variant)). The non-AP STA responds (solicited BSR) as defined below:

* The non-AP STA that receives a BSRP Trigger frame shall follow the rules defined in 26.5.2.3 (Non-AP STA behavior for UL MU operation) to generate the HE TB PPDU if the Trigger frame contains the 12 LSBs of the non-AP STA’s AID in any of the User Info fields; otherwise if the non-AP STA’s buffers are not empty and the non-AP STA supports the UL OFDMA-based random access procedure, it may follow the rules defined in 26.5.4 (UL OFDMA-based random access (UORA)) to gain access to an RA-RU and generate the HE TB PPDU when the Trigger frame contains one or more RA-RUs.
* The non-AP STA shall include in the HE TB PPDU one or more QoS Null frames containing one or more of the following:
* The QoS Control field(s) with Queue Size subfields for each of the TIDs for which the non-AP STA has queue size(s)*(#21346)* to report to the AP.
* The BSR Control subfield with the Queue Size All subfield indicating the queue size for the(#20530) ACs, indicated by the ACI Bitmap subfield, for which the non-AP STA has queue size*(#21346)* to report to the AP if the AP has indicated its support in the BSR Support subfield of its HE Capabilities element. The non-AP STA shall set Delta TID, SF, ACI High and Queue Size High subfields of the BSR Control subfield as defined in 9.2.4.6a.4 (BSR Control).
* The non-AP STA shall not solicit an immediate response for the frames carried in the HE TB PPDU (e.g., the Ack Policy subfield of a QoS Null frame(#21343) shall not be set to Normal Ack or Implicit Block Ack Request).

NOTE 1—As with unsolicited BSR, the STA might include a BSR Control subfield in a QoS Null frame that is sent in response to the BSRP Trigger frame. In this case, the Queue Size subfield in the QoS Control field and the Queue Size High and Queue Size All subfields(#Ed) in the BSR Control subfield might differ, and either or both might be 255 to indicate an unspecified or unknown queue size*(#21346)*.(#21343, #21344)

(#20495)NOTE 2—An AP does not send a BSRP Trigger frame containing the 12 LSBs of the AID of the non-AP STA that sets the UL MU Disable field to 1.

An AP may include a BSRP Trigger frame together with other Control, Data and Management frames in one A-MPDU to a non-AP STA if the HE Capabilities element received from the non-AP STA has the BSRP BQRP A-MPDU Aggregation field equal to 1. If a non-AP STA receives a BSRP Trigger frame aggregated with Control, Data and Management frames that solicits an acknowledgment, the response A-MPDU shall contain MPDUs in the order described in Table 9-531 (A-MPDU contents MPDUs in the control response context).

The NDP feedback report procedure described in 26.5.7 (NDP feedback report procedure) can be used for buffer status feedback operation. An AP that sent an NFRP Trigger frame to one or more non-AP STAs may send a BSRP Trigger frame to those non-AP STAs to get more precise buffer status information.