### IEEE P802.11 Wireless LANs

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| **REVme CR for assigned CIDs** | | | | |
| Date: 2023-12-10 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Alfred Asterjadhi | Qualcomm Inc. | San Diego, California |  |  |

Abstract

This document contains proposed resolutions for several SA comments on REVme (5 CIDs):

* 6599,
* 6600,
* 6601, 6602, 6603,
* 6196

**Changes to be done w.r.t. D4.0 of REVme.**

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Revised version of the document includes addition of resolutions for recently assigned CID 6196.
* Rev 2: Adopted suggestions received during the presentation, and addressed a couple of comments from Mark (moved TWT wake interval at the start of each sentence to make the sentences more concise, and specified that the rollover is with regards to the most significant octets of the TSF timer, changes 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 REVme Draft. This introduction is not part of the adopted material.

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

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

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| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| 6599 | Asterjadhi, Alfred | 643.21 | Multi TID BAR is removed from the spec. However, 11ax uses it as a variant of MU BAR Trigger frame, and also as part of the protocols for multi-TID A-MPDU. | Please add Multi-TID BAR frame to the draft | Revised –  Agree in principle with the comment. Please refer to detailed discussions in 11-23/2155.  TGme editor: please implement changes as shown in 11-23/2155r2 under all headings that include CID 6599. |

**Discussion: *Subclause 9.3.1.7.4 (Multi-TID BlockAckReq variant) was removed as a result of the resolution for CID 4251 submitted during LB273, which listing from 11-22/0065r22 is shown below:***

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| ***CID*** | ***Commenter*** | ***P.L*** | ***Comment*** | ***Proposed Change*** | ***Accepted Resolution*** |
| *4251* | *Mark RISON* | *1955.21* | *"The Multi-TID BlockAck variant shall not be used." -- but there are still references to it (note: EDMG MTBA is a different frame)* | *Delete the cited sentence and 9.3.1.8.3 Multi-TID BlockAck variant. At 1411.4, 1732.7, 1799.55/57, 1956.45, 2004.19/20, 2337.1/2/26/29/37, 5543.24 insert "EDMG " before "Multi-TID BlockAck" (adjust article where necessary). In B.4 make QB4.4, QB4.4.1 reserved* | *Accepted* |

***The comment is referring to a statement related to multi-TID blockack variant, not multi-TID BlockAckReq variant. Similar observation for the proposed change, which instructs the editor to remove subclauses and amend text related to multi-TID BlockAck frames. Hence, it seems that there is an error when executing this propose change. Proposed resolution is to add back Multi-TID BAR and remove the subclause 9.3.1.8.3 (Multi-TID BA).***

**REme Editor: *Insert the subclause below (#CID 6599):***

**9.3.1.7.3a Multi-TID BlockAckReq variant**

The TID\_INFO subfield of the BAR Control field of the Multi-TID BlockAckReq frame determines the number of TIDs present in the Multi-TID BlockAckReq frame as given by TID\_INFO + 1, e.g., a 2 in the TID\_INFO subfield means that three TID values are present in the Multi-TID BlockAckReq frame’s BAR Information field.

The BAR Information field of the Multi-TID BlockAckReq frame comprises multiple sets of Per TID Info subfields and Block Ack Starting Sequence Control subfields, as shown in Figure 9-49 (BAR Information field format (Multi-TID BlockAckReq)). The Per TID Info subfield is shown in Figure 9-50 (Per TID Info subfield format). The Block Ack Starting Sequence Control subfield is shown in Figure 9-48 (Block Ack Starting Sequence Control subfield format). The Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield contains the sequence number of the first MSDU or A‑MSDU for which this BlockAckReq frame is sent. The Fragment Number subfield of the Block Ack Starting Sequence Control subfield is set to 0.

|  |  |  |
| --- | --- | --- |
| Octets: | 2 | 2 |
|  | Per TID Info | Block Ack Starting Sequence Control |
|  | Repeat for each TID | |
| * **BAR Information field format (Multi-TID BlockAckReq)** | | |

|  |  |  |
| --- | --- | --- |
|  | B0 B11 | B12 B15 |
|  | Reserved | TID Value |
| Bits: | 12 | 4 |
| * **Per TID Info subfield format** | | |

**REme Editor: *Please delete subclause 9.3.1.8.3 (Multi-TID BlockAck variant) (#CID 6599).***

**REme Editor: *Please replace “Multi-TID” with “Reserved” in Table 9-37 (#CID 6599).***

**REme Editor: *Please replace “Multi-TID Block Ack” with “Reserved” in row QB4.4 and delete the contents of the remaining columns of that row (#CID 6599).***

**REme Editor: *Please delete all references to 9.3.1.8.3 (Multi-TID BlockAck variant) from Annex B (#CID 6599).***

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| **CID** | **Commenter** | **Clause** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| 6601 | Asterjadhi, Alfred | 26.8.3.2 | Since the TWT contains a partial TSF value it is possible that when the STA schedules for transmission the frame the TWT value might refer to a time that has actually passed when the frame is actually transmitted (16 bit rotation happens between the queueing and actual transmission). I think this may be an issue for different functionalities that are relying on partial TSFs and intend to signal a future value. | Please fix the issue for TWT field in B-TWT, and also check the cases of STACK, TACK, TSPEC, TWT Information frame, etc. | Revised –  Agree in principle with the comment. Proposed resolution clarifies the wording on the AP side behavior and addresses the ambiguity at the STA side by adding a note and declarative descriptions regarding how to obtain the subsequent TWTs based on the TWT and TWT wake interval fields.  Went over STACK, TACK, TSPEC, and TWT INFORMATION frames and add a similar note wherever applicable.  TGme editor: please implement changes as shown in 11-23/2155r1 under all headings that include CID 6601. |
| 6602 | Asterjadhi, Alfred | 26.8.3.3 | Similar comment to the AP side, now on the STA side. If the obtained TWT from a TWT parameter set is pointing to a value in the past (as opposed to the future) then this is because the frame containing the TWT field has been waiting in the queue for enough time to cause the partial TSF value rotation. Hence the STA needs to ensure that the correct value is determined (i.e., in the future rather than the past). | Clarify that if the obtained TWT from frames that contain partial TWT information is referring to the past then the actual value is the one that is obtained by assuming a 12 bit rotation (i.e., MSB of the main TWT is increased by one). Check that this issue is fixed for all fields that contain a future time in the format of a partial TSF (e.g., TACT, STACK, TWT infor, TSPECT, etc). | Revised –  Agree in principle with the comment. Proposed resolution clarifies the wording on the AP side behavior and addresses the ambiguity at the STA side by adding a note and declarative descriptions regarding how to obtain the subsequent TWTs based on the TWT and TWT wake interval fields.  Went over STACK, TACK, TSPEC, and TWT INFORMATION frames and add a similar note wherever applicable.  TGme editor: please implement changes as shown in 11-23/2155r1 under all headings that include CID 6602. |
| 6603 | Asterjadhi, Alfred | 26.8.3 | Need to specify how a sub 1 TU schedule is maintained and advertised. This would help in scenarios where a sub 1 TU resolution is needed | As in comment. | Revised –  Agree in principle with the comment. Proposed resolution adds behavior to cover this case. Please refer to detailed discussions in 11-23/2155.  TGme editor: please implement changes as shown in 11-23/2155r1 under all headings that include CID 6603. |

### Discussion: *In subclause 9.4.2.199 (TWT element), we have the following Broadcast TWT Parameter Set field format:*

*A diagram of a few different times

Description automatically generated with medium confidence*

***Figure 9-766-Broadcast TWT Parameter Set field format***

*The Broadcast TWT Parameter Set field includes a Target Wake Time field that is 2 octets.*

*Also, per baseline REVme D1.3, in subclause 9.4.2.199 (TWT element), the Target Wake Time field is 8 octets in case of Individual TWT whereas in case of Broadcast TWT, the Target Wake Time field is 2 octets with the lowest bit of the 2 octets corresponding to bit 10 of the relevant TSF value.*

*In addition, per baseline REVme D1.3 P4218L41, we have: The TWT scheduling AP shall set the Target Wake Time field to TSF [10:25], where TSF corresponds to the next TWT that is scheduled for this TWT parameter set when it queues for transmission the frame that contains the TWT element. The TSF timer at which the next TWT is scheduled has bits 0 to 9 equal to 0 and bits 26 to 63 equal to the same value as the respective bits in the current TSF timer.*

*Thus, the current rules allow to negotiate a Target Wake Time that has 1 TU resolution (>= 1024 µsec). However, latency sensitive traffic such as XR and cloud gaming traffic arrival is defined it terms of frames per second (fps), e.g., 60 fps (1 frame every 16.667 ms), and hence requires a finer time resolution. Although, the TWT Wake Interval allows a lower resolution, the upcoming TWT beacon announcements will carry only 1 TU resolution. Thus, the difference between the start time of the B-TWT SP and the latency sensitive traffic arrival will get accumulated. As a result, the current Target Wake Time field does not allow to align the latency sensitive traffic arrival time with the B-TWT SP start time and the latency sensitive traffic may not be able to benefit from the B-TWT SP. In this proposal, we address this issue.*

***Target Wake Time field mismatch issue:***

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*We add a NOTE as good practice for implementation to avoid decoding errors that can happen at the receiving STA where the receiving STA use different B63-B26 than those intended by the transmitting STA for determining the SP start time during the lifetime of an B-TWT schedule.*

**26.8.3.2 Rules for TWT scheduling AP**

**REme Editor: *Please change the paragraphs of the subclause below (#CID 6601, 6602, 6603):***

The TWT scheduling AP shall set the Target Wake Time field to TSFRef [10:25], where TSFRef corresponds to:

* If the TWT wake interval of the TWT parameter set is a multiple of 1 TU or is 0, the next TWT scheduled for this TWT parameter set that will occur after the AP has queued for transmission the frame that contains the TWT element. The TSF timer at which the next TWT is scheduled has bits 0 to 9 equal to 0 and bits 26 to 63 equal to the same value as the respective bits in the current TSF timer.
* Otherwise, the first TWT scheduled for this TWT parameter set that had occurred immediately after the TSF timer was 0. The TSF timer at which the first TWT was scheduled had bits 0 to 9 and bits 26 to 63 equal to 0.

The TWT scheduling AP shall include a nonzero value for the TWT wake interval in the TWT Wake Interval Exponent and TWT Wake Interval Mantissa fields for a periodic TWT and a zero value for an aperiodic TWT. The TWT wake interval shall be a multiple of 1 TU unless the TWT scheduling AP intends to advertise a TWT wake interval that is not a multiple of 1 TU (i.e., with a resolution less than 1 TU).

**26.8.3 Broadcast TWT operation**

**26.8.3.1 General**

**REme Editor: *Please change the paragraph of the subclause below (#CID 6601, 6602, 6603):***

A non-AP HE STA shall obtain TWT parameter values from the most recently received TWT element carried in a Beacon, Probe Response, or (Re)Association Response frame from its associated AP, unless the non-AP HE STA is associated with an AP corresponding to a nontransmitted BSSID of a multiple BSSID set. In this case, it shall follow the rules in 11.1.3.8.4 (Inheritance of element values) to determine the TWT parameter values.

The non-AP HE STA determines the start time of a subsequent TWT of a TWT parameter set from:

* The TWT wake interval and the next TWT derived from the value in the Target Wake Time field of the TWT parameter set contained in the received TWT element and the current TSF timer (see 26.8.3.2) if the TWT wake interval of the TWT parameter set is a multiple of 1 TU or is 0.
* The TWT wake interval and the first TWT derived from the value in the Target Wake Time field of the TWT parameter set contained in the received TWT element (see 26.8.3.2) if the TWT wake interval of the TWT parameter set is greater than 0 and is not a multiple of 1 TU.

NOTE—The Target Wake Time field carries only B10:B25 of the relevant TSF timer, and changes in B26:B63 of the corresponding TSF timer are not explicitly communicated to the receiving STA. Hence, the STA must consider when setting up a broadcast TWT schedule the rollover of B26:B63 of the TSF timer that might happen at the receiving STA during the lifetime of the broadcast TWT schedule (i.e., resulting from the Target Wake Time field and Broadcast TWT Persistence field).

**REme Editor: *Please change the paragraph of the subclause below (#CID 6601, 6602, 6603):***

Negotiations to become a member of or terminate membership in a broadcast TWT, identified by a Broadcast TWT ID subfield greater than 0, are performed with an exchange of frames that carry TWT elements with the Negotiation Type subfield set to 3 as described in 26.8.3.3 (Rules for TWT scheduled STA). TWT STAs that intend to negotiate a broadcast TWT schedule, which has a TWT wake interval that is not a multiple of 1 TU, shall set the the Target Wake Time field of the exchanged TWT elements to TSFRef [10:25], where TSFRef is the start time of the TWT of the corresponding broadcast TWT schedule, if it were to happen immediately after TSF time 0.

**9.8.4.2 STACK frame format**

**REme Editor: *Please change the paragraph of the subclause below (#CID 6601, 6602, 6603):***

If the Next TWT Info Present subfield in the Frame Control field is equal to 1 and the Flow Control subfield of the Frame Control field is equal to 0, then the Tetrapartial Timestamp/Next TWT Info/Suspend Duration field contains the value of the 4 least significant octets of the TSF timer for the next TWT logically ANDed with the value 0xFFFFFFF8 and then added to the value of the TWT flow identifier that corresponds to that next TWT value.

NOTE—The Next TWT Info/Suspension Duration field carries only a portion of the TSF timer, and changes in the most significant octets of the corresponding TSF timer are not communicated to the receiving STA. Hence, the receiving STA must consider and account for a rollover of the most significant octets of the TSF timer that might happen at the receiving STA.

**9.4.2.28 TSPEC element**

**REme Editor: *Please change the paragraph of the subclause below (#CID 6601, 6602, 6603):***

The Service Start Time field contains an unsigned integer that specifies the time, expressed in microseconds, when the first scheduled SP starts. The service start time indicates to the AP the time when a STA first expects to be ready to send frames and a power saving STA needs to be awake to receive frames. This might help the AP to schedule service so that the MSDUs encounter small delays in the MAC and help the power saving STAs to reduce power consumption. The field represents the four lower order octets of the TSF timer at the start of the SP. If APSD and Schedule subfields are 0, this field is also set to 0 (unspecified).

NOTE—The Service Start Time field carries only a portion of the TSF timer, and changes in the most significant octets of the corresponding TSF timer are not communicated to the receiving STA. Hence, the receiving STA must consider and account for a rollover of the most significant octets of the TSF timer that might happen at the receiving STA.

**9.4.1.58 TWT Information field**

**REme Editor: *Please change the paragraph of the subclause below (#CID 6601, 6602, 6603):***

The Next TWT subfield is of a variable size as determined by the Next TWT Subfield Size subfield value according to Table 9-112 (Next TWT Subfield Size subfield encoding). The value contained in the Next TWT subfield is the least significant portion of the TSF at the next TWT for the TWT specified by the TWT Flow Identifier subfield.

NOTE—The Next TWT subfield might carry only a portion of the TSF timer, and changes in the most significant octets of the corresponding TSF timer are not communicated to the receiving STA. Hence, the receiving STA must consider and account for a rollover of the most significant octets of the TSF timer that might happen at the receiving STA.

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| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| 6196 | RISON, Mark | 2613.15 | "from existing TWT values" is not clear. Also 3x on p. 3930 | Change to "from one of the values of the Next TWT field used for existing TWT agreements" | Revised –  Agree in principle with the comment. Accounted for the proposed changes.  TGme editor: please implement changes as shown in 11-23/2155r1 under all headings that include CID 6196. |

**11.21.15 Channel usage procedures**

**REme Editor: *Please change the paragraph of the subclause below (#CID 6196):***

A non-AP STA may suspend a peer-to-peer TWT agreement by sending a TWT Information frame with the TWT Flow Identifier field set to the value of the TWT Flow Identifier field of the TWT element in the Channel Usage Response frame that concluded the setup of the corresponding peer-to-peer TWT agreement if the AP has set the TWT Information Frame Disabled field to 0 in the TWT element sent during the TWT setup; otherwise, the non-AP STA shall not transmit a TWT Information frame to the AP. If the Next TWT subfield is present in the TWT Information frame, the value of the Next TWT subfield shall be selected from the future target wake times of the corresponding peer-to-peer TWT agreement.

**26.8.4 Use of TWT Information frames**

**26.8.4.1 General**

**REme Editor: *Please change the paragraph of the subclause below (#CID 6196):***

The TWT Information frame shall have the Response Requested subfield equal to 0, the Next TWT Request

subfield equal to 0, and one of the following:

* The Next TWT subfield that is equal to a nonzero value if the frame is transmitted by a TWT responding STA, by a TWT scheduling AP, or by any HE STA to a peer STA that has set the Flexible TWT Schedule Support field to 1 in the HE Capabilities element it transmits.
* The value of the Next TWT subfield shall be selected from the future target wake times of an individual TWT agreement if the Flexible TWT Schedule Support field in the HE Capabilities element received from the peer STA is 0 and shall be selected from the future target wake times of a broadcast TWT schedule regardless of the value of the Flexible TWT Schedule Support field received from the peer STA.
* The Next TWT subfield may contain any nonzero value if the Flexible TWT Schedule Support field in the HE Capabilities element received from the peer STA is 1.
* The All TWT subfield is 1 if the resumption applies to all broadcast TWT schedules followed by the TWT scheduled STA and/or to all individual TWT agreements followed by the TWT responding STA.
* A Next TWT subfield that is present if the frame is transmitted by a TWT requesting STA, by a TWT scheduled STA, or by any HE STA to a peer STA that has set the Flexible TWT Schedule Support field to 1 in the HE Capabilities element it transmits.
* The Next TWT subfield indicates the earliest TWT at which the individual TWT agreement or broadcast TWT schedule is resumed and shall be selected from the future target wake times of that TWT agreement or broadcast TWT schedule if the Flexible TWT Schedule Support field in the HE Capabilities element received from the peer STA is 0.
* The All TWT subfield is 1 if the resumption applies to all broadcast TWT schedules followed by the TWT scheduled STA and/or to all individual TWT agreements followed by the TWT requesting STA.

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