IEEE P802.11
Wireless LANs

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| Comment resolutions for TWT power save |
| 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 (7 CIDs):

* 20233, 20234, 20235, 20406, 20836, 21204, 21205

Revisions:

* Rev 0: Initial version of the document.

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.***

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| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 20233 | Huizhao Wang | 383.57 | Rules of TWT termination by More Data bit = 0 is too broad | This paragraph will allow inadvertly TWT termination if any of the control or mgmt frame individually addressed to the STA without the More data bit set to 1. Please remove it | Rejected –The comment is out of scope: i.e., it is not on changed text, text affected by changed text or text that is the target of an existing valid unsatisfied comment.Please note that the AP sets the MD bit to 1 to indicate that it has DL BUs for the STA; and sets it to 0 otherwise. If the AP has no data for the STA then STA can go to doze state. There is nothing inadvertent about the rule. Also please note that the AP explitly declares support of setting the MD to 1 in control response frames by setting the More Data Ack field in the QoS Info field it transmits. |
| 20234 | Huizhao Wang | 384.01 | Rules of TWT termination by More Data bit = 0 is too broad | Same reason as above, please remove it | Rejected –The comment is out of scope: i.e., it is not on changed text, text affected by changed text or text that is the target of an existing valid unsatisfied comment.Please note that the AP sets the MD bit to 1 to indicate that it has DL BUs for the STA; and sets it to 0 otherwise. If the AP has no data for the STA then STA can go to doze state. There is nothing inadvertent about the rule. Also please note that the AP explitly declares support of setting the MD to 1 in control response frames by setting the More Data Ack field in the QoS Info field it transmits. |
| 20235 | Huizhao Wang | 384.06 | This rule does not make sense, it allows TF which is not addressed to the TWT STA to accidentally terminate its TWT SP | Please change the text to:""equal to 0 and is addressed to the TWT requesting STA..." | Rejected –The comment is out of scope: i.e., it is not on changed text, text affected by changed text or text that is the target of an existing valid unsatisfied comment. |
| 20406 | Liwen Chu | 384.55 | the behavior related with this is not defined. | Add the ralated behavior or delete the bullet | Rejected –The comment is out of scope: i.e., it is not on changed text, text affected by changed text or text that is the target of an existing valid unsatisfied comment.Please note that the normative behavior is already covered since the bullet covers the normative behavior of the Nominal Minimum TWT Duration field covers, which is the requested TBTT wake duration. This value is then used be the TWT responder to select the appropriate duration sent in response in the same field in the TWT response.  |
| 20836 | Mark RISON | 384.05 | "The reception of a Trigger frame sent by the TWT responding STA or TWT scheduling AP thathas the More TF field equal to 0 and is not addressed to the TWT requesting STA or TWTscheduled STA" -- reception of a Trigger frame intended for the STA with More TF set to 0 should be a TWT SP termination event too, once the TF has been responded to | As it says in the comment | Rejected –The AP uses the More TF field to indicate intention of sending additional Trigger frames to other STAs that are not currently being triggered. This is to ensure that these STAs continue staying awake for subsequent triggering. As fo the STA that is the intended recipient of the Trigger frame, this STA has declared to be in awake state by responding to the Trigger and may be signaled to go to doze state by the AP by setting the More Data bit to 0 in the control response sent to the STA or by sending a frame with the EOSP field equal to 1.  |
| 21204 | Pooya Monajemi | 384.13 | A Multi-STA BlockACK can be sent to the broadcast address, and the More Data field would only be valid on individually addressed Control frames. | Replace "Multi-STA BlockAck" with "individually addressed Multi-STA BlockAck" | Accepted |
| 21205 | Pooya Monajemi | 384.13 | This is just adding another case to the above list | Rewrite as "6) The reception of ..." | Rejected –The comment is out of scope: i.e., it is not on changed text, text affected by changed text or text that is the target of an existing valid unsatisfied comment.Please note that this paragraph is explaining that More Data bit equal to 0 in these control response frames is classifiable as an early termination only if both STAS have indicated support of receiving this setting in the control response frames (via the capabilities bit mentioned in the paragraph itself). However, the normative behavior itself for the early termination of the TWT SP based on the reception of these frames can be found in bullet 4:4) The reception of an individually addressed frame that is neither a QoS Data frame nor a QoS Null frame, sent by the TWT responding STA or TWT scheduling AP, that does not solicit an immediate response and with the More Data field equal to 0. |

**Discussion: *None.***

* Power save operation during TWT SPs

The following rules apply to TWT SPs for both broadcast TWT schedules and individual TWT agreements where the TWT SP of a broadcast TWT is uniquely identified by the <broadcast TWT ID, MAC address of TWT scheduling AP> tuple and the TWT SP of an individual TWT is uniquely identified by the <TWT flow identifier, MAC address of TWT requesting STA, MAC address of TWT responding STA> triple.

A TWT requesting STA or a TWT scheduled STA that is not in PS mode and that transmits a frame with the Power Management subfield set to 1 during a TWT SP shall remain in the awake state until the AdjustedMinimumTWTWakeDuration time has elapsed from the TWT SP start time or until a TWT SP termination event is detected, whichever occurs first for that particular TWT SP.

A TWT requesting STA or a TWT scheduled STA in PS mode that is in the awake state for a TWT SP may transition to the doze state after AdjustedMinimumTWTWakeDuration time has elapsed from the TWT SP start time even if it has previously transmitted a PS-Poll frame or U-APSD trigger frame and has not yet received the expected frames from the AP in response. For a trigger-enabled TWT SP, if the AdjustedMinimumTWTWakeDuration time has elapsed from the scheduled TWT SP start time and no Trigger frames are received by the STA, the HE STA may enter doze state if no other condition requires the STA to remain awake.(#15113)

When a TWT SP termination event is detected within a TWT SP by a STA in PS mode that is participating in the TWT SP, the STA may transition to the doze state without waiting for the expiration of the AdjustedMinimumTWTWakeDuration time as described in 10.43.1 (TWT Overview), even if it has previously transmitted a PS-Poll frame or U-APSD trigger frame and has not yet received the expected frames from the AP in response.

A TWT requesting STA or a TWT scheduled STA shall classify any of the following events as a TWT SP termination event:

* (#16429)The transmission by the TWT requesting STA or TWT scheduled STA of an acknowledgment in response to an individually addressed QoS Data or QoS Null frame sent by the TWT responding STA or TWT scheduling AP, respectively, that had the EOSP subfield equal to 1.
* The transmission by the TWT requesting STA or TWT scheduled STA of an acknowledgment in response to an individually addressed frame that is neither a QoS Data frame nor a QoS Null frame, sent by the TWT responding STA or TWT scheduling AP, respectively, with the More Data field equal to 0.
* The reception of an individually addressed or broadcast QoS Data or QoS Null frame sent by the TWT responding STA or TWT scheduling AP, that does not solicit an immediate response and with the EOSP subfield equal to 1.
* The reception of an individually addressed frame that is neither a QoS Data frame nor a QoS Null frame, sent by the TWT responding STA or TWT scheduling AP, that does not solicit an immediate response and with the More Data field equal to 0.
* The reception of a Trigger frame sent by the TWT responding STA or TWT scheduling AP that has the More TF field equal to 0 and is not addressed to(#16149) the TWT requesting STA or TWT scheduled STA provided that the TWT requesting STA or TWT scheduled STA is either awake for an announced trigger-enabled TWT SP but did not transmit an indication that it is in the awake state to the TWT responding STA or TWT scheduling AP or is awake for an unannounced trigger-enabled TWT SP.

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 21204):***

The classification of a More Data field equal to 0 in an Ack, BlockAck and individually addressed Multi-STA BlockAck frame as an event that terminates a TWT SP is only possible when both STAs have indicated support of transmitting or receiving the frame with a nonzero More Data subfield, which is indicated in the More Data Ack subfield of the QoS Info field of frames they transmit (see 11.2.2 (Power management in a non-DMG infrastructure network)).*(#21204)*

NOTE 1—A STA participating in multiple TWT SPs which overlap in time stays in the awake state until the latest AdjustedMinimumTWTWakeDuration time of all of the TWT SPs expires, except that a TWT SP termination event causes all of the overlapping TWT SPs to terminate.

NOTE 2—A Trigger frame is addressed to the STA if the Trigger frame contains the AID of the STA in one of its Per User Info fields (see 26.5.3 (UL MU operation)), and has in its TA field either the MAC address of its associated AP or the transmitted BSSID (see 26.5.3.2.4 (Allowed settings of the Trigger frame fields and TRS Control subfield)). Otherwise, the Trigger frame is not addressed to the STA. If the Trigger frame contains one or more RA-RUs for which the STA can gain access according to 26.5.5 (UL OFDMA-based random access (UORA)) then the STA can follow the rules defined in 26.14.2 (Power save with UORA and TWT) to determine an early TWT SP termination event.(#15103)

Additional TWT SP termination events for a TWT requesting STA occur after the successful exchange of a TWT Information frame with the TWT responding STA as defined in 26.8.4.2 (TWT information for individual TWT) and in 26.8.4.4 (TWT information for flexible TWT).

Additional TWT SP termination events for a TWT scheduled STA occur after the successful exchange of a TWT Information frame with the TWT scheduling AP as defined in 26.8.4.3 (TWT information for broadcast TWT) and in 26.8.4.4 (TWT information for flexible TWT).(#16429)

* Negotiation of wake TBTT and wake interval

A TBTT scheduled STA(15098) that intends to operate in power save mode (see 11.2.2.2 (STA Power Management modes)) may transmit a TWT request(#16466) to the TBTT scheduling AP(15098) that identifies the wake TBTT of the first Beacon frame and the wake interval between subsequent Beacon frames it intends to receive. The TWT request(#16466) shall contain:

* The Negotiation Type subfield equal to 1 and the TWT Command field to Suggest TWT or Demand TWT
* The requested first wake TBTT in the Target Wake Time field
* The requested wake interval between consecutive TBTTs in the TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields
* The requested TBTT wake duration in the Nominal Minimum TWT Wake Duration field
* All other fields in the TWT element are reserved.

A TBTT scheduling AP(15098) that receives a TWT request(#16466) from a STA whose value of the Negotiation Type subfield is 1 shall respond with a TWT response(#16466) that contains either Accept TWT, Alternate TWT, or Reject TWT in the TWT Command field and, in the case of an Accept TWT, it shall also contain:

* The Negotiation Type subfield equal to 1
* The allocated first wake TBTT in the Target Wake Time field
* The allocated wake interval between consecutive TBTTs in the TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields
* The allocated TBTT wake duration in the Nominal Minimum TWT Wake Duration field
* All other fields in the TWT element are reserved

After successfully completing the negotiation, the TBTT scheduled STA(15098) may go to doze state until its TSF matches the next negotiated wake TBTT provided that the STA is in power save mode, and no other condition requires the STA to remain awake. The TBTT scheduled STA(15098) shall be in the awake state to listen to Beacon frames transmitted at negotiated wake TBTTs and shall operate as described in 26.8.3.3 (Rules for TWT scheduled STA).

If the TBTT scheduled STA(15098) receives a Beacon frame from the TBTT scheduling AP(15098) at or after TBTT, the TBTT scheduled STA(15098) may go to doze state until the next wake TBTT if no other condition requires the STA to remain awake. The TBTT scheduled STA(15098) may go to doze state after a nominal minimum TBTT wake duration time has elapsed from the TBTT start time if no other condition requires the STA to remain awake.(#16466)

Either STA that is a party to an established wake TBTT agreement can tear down the wake TBTT agreement by following the tear down procedure described in 10.43.8 (TWT Teardown) and by setting the Negotiation Type subfield to 1 in the TWT Teardown frame.

Table 26-8 (Wake TBTT negotiation exchanges) summarizes the interactions between devices that negotiate a Wake TBTT agreement.

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| * Wake TBTT negotiation exchanges
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| TWT Setup Command field in an initiating frame | TWT Setup Command field in a response frame | Condition after the completion of the exchange |
| Request TWT | Accept TWT or Alternate TWT or Dictate TWT or Reject TWT or no response | This exchange is not allowed. |
| Demand TWT or Suggest TWT | Accept TWT | A Wake TBTT agreement has been created with the Wake TBTT parameters indicated in the initiating frame. |
| Demand TWT or Suggest TWT | Reject TWT | No Wake TBTT agreement has been created. |
| Demand TWT or Suggest TWT | Alternate TWT | No Wake TBTT agreement has been created. The TBTT scheduling AP(15098)(#16466) is offering an alternative set of parameters vs. those indicated in the initiating frame. The TBTT scheduled STA(15098) can send a new request with any set of Wake TBTT parameters and the responder might create a Wake TBTT agreement using those parameters.The TBTT scheduled STA(15098) is unlikely to send a new request if the TWT Setup Command is Demand TWT and is very likely to send a new request if the TWT Setup Command is Suggest TWT. |
| NOTE 1—The Negotiation Type field of the TWT element contained in these frames is equal to 1. NOTE 2—The initiating frame and response frame settings not listed in the tables in 10.48 (Target wake time (TWT)) or 26.8 (TWT operation) are not allowed. The initiating frame is a TWT request and the response frame is a TWT response. |