IEEE P802.11  
Wireless LANs

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| Comment resolutions for 27.7.3.3 | | | | |
| Date: 2018-05-01 | | | | |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D2.0 with the following CIDs:

* 11844, 11846, 11847, 12184, 12238, 12523, 12524, 12525, 12526, 12527,
* 13790, 12306 (12 CIDs)

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.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 11844 | Guoqing Li | 279.42 | The STA may have individual TWT agreement with the AP in addition to broadcast TWT, therefore asking the STA "should not transmit outside of broadcast TWT" is too general | Add the condition that"..if the STA does not have other TWT agreements" | Revised –  Agree in principle with the comment. Proposed resolution adds clarification text inline with the suggested change.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 11844. |
| 11846 | Guoqing Li | 281.34 | Even if the STA has established memebership in the broadcast TWT, if this is an announced TWT, the STA does not need to be in awake state. | Please include the condition that this is for unannounced TWT | Revised –  Agree in principle with the comment. Proposed resolution accounts for the suggested change.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 11846. |
| 11847 | Guoqing Li | 281.52 | The first sentence in this paragraph adds no value because a STA transmits TB PPDU as response to trigger regardless of TWT status. UL MU response behavior has nothing to do with TWT. | Remove the first sentence in this paragraph. | Rejected –  This is a declarative statement that provides a reference to the normative behavior the STA is required to follow when operating within a trigger-enabled TWT and receives a Trigger frame. These declarative statements are widely used in the spec to provide references where additional functionalities are explained. |
| 12184 | kaiying Lv | 279.42 | Change to "within trigger-enabled broadcast TWT" | Please clarify it | Revised –  Agree with comment and incorporated the changes.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 12184. |
| 12238 | kaiying Lv | 281.16 | The discription of "Alternate TWT" is inconsistent with Table 27-3. It should be permitted to be transmitted by a TWT scheduling AP. | Delete "or a TWT scheduling AP."And add a sentence such as :"When transmitted by a TWT scheduling AP, the...." | Revised –  Agree with comment and incorporated the changes.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 12238. |
| 12523 | Liwen Chu | 279.42 | what if the TWT STA is also individual TWT requesting STA | Fix the issue mentioned in comment. | Revised –  Agree in principle with the comment. Proposed resolution is to clarifiy that the STA can transmit frames within negotiated individual TWT SPs.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 12238. |
| 12524 | Liwen Chu | 279.43 | "...within trigger-enabled TWT SPs."  Make it clear that if not scheduled, the STA should not transmit ... in Trigger-enabled TWT SPs. | Fix the issue mentioned in comment. | Revised –  The STA should not transmit frames especially if it was not scheduled to transmit during that TWT SP. However, the STA is excempt from this recommendation when the AP has negotiated with the STA individual TWTs that would otherwise enable the STA to transmit.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 12524. |
| 12525 | Liwen Chu | 279.50 | The combination of Demand TWT and Alternate TWT is allowed by individual TWT negotiation. Why it is disallowed by broadcast TWT negotiation? | Allow it. | Revised –  The intention is to limit the possible combinations. In this case proposal is to simply allow Alternate TWT in response to the two types of commands for consistency. Also removed the row below because we already say that sequences not listed in the tables are not allowed.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 12525. |
| 12526 | Liwen Chu | 281.16 | It is allowed by scheduling AP. | Allow it. | Revised –  Agree with comment. Accounted for the suggested change.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 12526. |
| 12527 | Liwen Chu | 281.19 | It is allowed by scheduling AP. | Allow it. | Revised –  Agree with comment. Accounted for the suggested change.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 12527. |
| 13790 | Yanjun Sun | 280.62 | A TWT Scheduled STA can send a new request if the previous request with TWT Setup Command = Suggest or Demand had failed | Add the following sentence at the end of exiting text to row 5 column 'Condition after the completion of the exchange' : "The TWT scheduled STA can send a new request with any set of TWT parameters and the TWT scheduling AP might entertain the creation of a new broadcast TWT schedule using the parameters indicated in the responding frame" | Revised –  Agree in principle. The behavior is not with any set of TWT parameters, but with the parameters specified in the Dictate TWT response. Proposed resolution clarifies this aspect.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID 13790.  TGax editor to make the changes shown in 11-18/0664r0 under all headings that include CID AA. |
| 12306 | Laurent Cariou | 129.27 | TWT flow identifier is used for broadcast TWT to indicate the target transmission time of specific frames, like TIM element, or OFDMA random access. There are currently no ways to indicate the target transmission time of NDP feedback report triggers, while these triggers are meant to be sent in a regular manner. | Modify the TWT flow identifier for broadcast TWT table to define an explicit way to schedule NDP feedback report triggers. The simplest solution is to define a new field value specifically for NDP feedback report. | Revised –  The allowance of NDP Feedback report poll was already added in the last CR as part of resolution of CIDs 12313, and 12409. If it is necessary to add it as a separate value then the spec needs to be amended so that the response does not appear in two places. |

**Discussion:** *The changes tagged with (#AA) are part of the harmonization of passed CRs in the TWT element, which changes were not spread to this subclause or are part of harmonization with CIDs in other subclauses that asked similar changes.*

* Rules for TWT scheduled STA

A TWT element with the Broadcast field equal to 1 is referred to as broadcast TWT element.(#8229) A TWT scheduled STA that receives a broadcast TWT element in a Beacon frame shall follow the rules defined in this subclause to interact with the TWT scheduling AP(#6919).

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 11844, 12184, 12523, 12524):***

A TWT scheduled STA should not transmit frames(#8285) to the TWT scheduling AP(#6919) outside of broadcast TWT SPs and within trigger-enabled broadcast TWT SPs, except that the STA can transmit frames within negotiated individual TWT SPs as defined in 27.7.2 (Individual TWT agreements).*(#11844, 12184, 12523, 12524)*

**TGax Editor: *Change the paragraphs below of this subclause as follows (#AA):***

A TWT scheduled STA may request to become a member of a broadcast TWT by transmitting a frame to its associated AP that contains a TWT element with the Negotiation Type subfield set to 3 and the TWT Command field set to Request TWT or Suggest TWT or Demand TWT. The TWT Parameter set indicates the Broadcast TWT ID of the broadcast TWT that the STA is requesting to join. See Table 27-4 (Broadcast TWT membership exchanges).*(#AA)* (#4767, #4846, #7210, #7211, #7212, #7213, #7214, #7215, #8084, #8423)

A TWT scheduled STA may terminate membership in a broadcast TWT by transmitting a frame to its associated AP that contains a TWT element with the Negotiation Type field set to 3 and the TWT Command field set to Reject TWT or by transmitting a TWT Teardown frame that has the Negotiation Type set to 3.*(#AA)* (#4767)(#4846)

A TWT scheduled STA that receives a TWT element with the TWT Request field equal to 0, the Negotiation Type subfield*(#AA)* equal to 3 and the TWT Command field equal to Accept is a member of the broadcast TWT identified by the <broadcast TWT ID, MAC address> tuple, where the broadcast TWT ID is the value of the Broadcast TWT ID subfield in the TWT element and the MAC address which is the TA of the MMPDU that contained the TWT element is equal to the MAC address of the AP with which the STA is associated, regardless of whether the TWT scheduled STA had previously transmitted a corresponding TWT element to the AP with the value Request TWT, Suggest TWT or Demand TWT in the TWT Command field.*(#AA)* (#4767)(#4846)

**TGax Editor: *Change the paragraphs and the table below of this subclause as follows (#CID 12238, 13790, 12526, 12527, AA):***

Valid broadcast TWT membership exchanges are described in Table 27-4 (Broadcast TWT membership exchanges). *(#AA)*

|  |  |  |
| --- | --- | --- |
| * Broadcast TWT membership exchanges | | |
| Initiating frame: TWT Setup Command field value within a TWT Setup frame transmitted from a first STA to a second STA, with Broadcast set to 1 and Wake TBTT Negotiation set to 1 | Response frame: TWT Setup Command field value within a TWT Setup frame transmitted from the second STA to the first STA with Broadcast set to 1 and Wake TBTT Negotiation set to 1 | Condition after the completion of the exchange |
| Demand TWT | Accept TWT | A broadcast TWT schedule exists or has been created with the TWT parameters indicated in the initiating frame and repeated in the responding frame.  The TWT scheduled STA transmitting the initiating frame is a member of the Broadcast TWT schedule identified by the Broadcast TWT ID and the TA of the response frame. *(#AA)* |
| Request TWT or Suggest TWT | Accept TWT | A broadcast TWT schedule exists or has been created with the TWT parameters indicated in the response frame.  The TWT scheduled STA transmitting the initiating frame is a member of the broadcast TWT schedule identified by the broadcast TWT ID and the TA of the response frame. *(#AA)* |
| Suggest TWT or Demand TWT*(#12525)* | Alternate TWT | No new broadcast TWT schedule has been created with the TWT parameters indicated in the initiating frame.  The TWT scheduling AP is offering an alternative set of parameters vs. those indicated in the initiating frame, as a means of negotiating TWT parameters with the TWT scheduled STA. *(#AA)*  The TWT scheduled STA can send a new request with any set of TWT parameters and the TWT scheduling AP might entertain the creation of a new broadcast TWT schedule using the parameters indicated in the responding frame. |
| Suggest TWT or Demand TWT | Dictate TWT | A broadcast TWT schedule is either created or already exists and is using the TWT parameters identified in the response frame, including a broadcast TWT ID.  The TWT scheduling AP*(#AA)* will not create any new broadcast TWT schedule with the TWT scheduled STA at this time.  The TWT scheduled STA*(#AA)* transmitting the initiating frame is not a member of the broadcast TWT schedule identified by the broadcast TWT ID and the TA of the response frame.  The TWT scheduled STA can send a new request, but will only receive an Accept TWT if it uses the dictated TWT parameters.*(#13790)* |
| Request TWT or Suggest TWT or Demand TWT | Reject TWT | The TWT scheduled STA transmitting the initiating frame is a not a member of a broadcast TWT identified by the broadcast TWT ID and the TA of the response frame, if such a broadcast TWT exists.  The TWT scheduling AP will not accept any new request from the TWT scheduled STA to join or create a broadcast TWT at this time.*(#AA)* |
| Accept TWT | No frame transmitted | Not permitted to be transmitted by a TWT scheduled STA.  When transmitted by a TWT scheduling AP, the recipient STA's membership in the broadcast TWT schedule identified by the broadcast TWT ID and the TA of the initiating frame is established. |
| Alternate TWT or Dictate TWT | No frame transmitted | Not permitted to be transmitted by a TWT scheduled STA.  When transmitted by a TWT scheduling AP, the TWT scheduled STA receiving this frame is not, through the receipt of this frame, a member of the broadcast TWT identified by the initiating frame.  The TWT scheduled STA can use the information provided to create a request to join a TWT in a subsequent initiating frame that it transmits. *(#12526, 12238)* |
| Reject TWT | No frame transmitted | When transmitted by a TWT scheduled STA, the transmitting STA's membership in the broadcast TWT schedule identified by the broadcast TWT ID and the RA of the initiating frame frame is terminated.  When transmitted by a TWT scheduling AP, the receiving STA's membership in the broadcast TWT schedule identified by the broadcast TWT ID and the TA of the initiating frame frame is terminated.*(#12527)* |
| NOTE-- In addition to the above exchanges,  2 Type3 MMPDUs that contain a broadcast TWT element generated by a TWT scheduled AP can be (Re)Association(#7931) Response, and TWT Setup frames with TWT Request field equal to 0. The TWT element has the Negotiation Type subfield equal to 3 and the Broadcast TWT ID(s) to which the STA is assigned to or is withdrawed from.*(#AA)* | | |

*(#AA)*

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 11846):***

A TWT scheduled STA that is in PS mode may enter the doze state after receiving a Beacon frame with a TWT element indicating the existence of a broadcast TWT and shall be in the awake state at the broadcast TWT start times which the STA has indicated it will be awake by either of the following:

1. Establishing a membership for the unannounced broadcast TWT with those broadcast TWT IDs,
2. Negotiating a wake TBTT and wake interval between Beacon frames that the STA receives, as defined in 27.7.6 (Negotiation of wake TBTT and wake interval),
3. Having sent a PS-Poll or APSD trigger frame during that beacon interval,
4. Having sent an indication that it is in the awake state during that beacon interval(#7634, #8086).*(#11846)* (#4767, #4846)

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

A TWT scheduled STA that did not receive a Beacon frame at a TBTT shall act is if it had received the expected Beacon frame containing a TWT element for a broadcast TWT, if the missed beacon corresponds to a TBTT that is within the next *n* TBTTs beyond the most recently received Beacon frame that included a TWT element for that broadcast TWT, where *n* is equal to one plus the value obtained from the Broadcast TWT Persistence Exponent and Broadcast TWT persistence Mantissa subfields of the corresponding Broadcast TWT, except that *n* is infinite when the Broadcast TWT Persistence Exponent subfield is 7 and the Broadcast TWT Mantissa subfield is 255.*(#AA)*

A TWT scheduled STA transmits an HE TB PPDU as a response to a Trigger frame that is intended for it and is sent during a trigger-enabled TWT SP (see 27.5.3 (UL MU operation)). A TWT scheduled STA(#6750) that is in PS mode and is awake during an announced TWT SP shall include a PS-Poll frame or an APSD trigger frame in the HE TB PPDU if it intends to solicit buffered BUs from the TWT scheduling AP(#6919) (see 11.2.2.8 (Receive operation for STAs in PS mode during the CP)) unless the STA has already transmitted within that TWT SP a PS-Poll(#6752) or APSD trigger frame or has transmitted any other indication that the STA is in the awake state within that TWT SP, or has, previous to the TWT SP, otherwise indicated to the AP that it is currently in the awake state(#5670). (#5065) A TWT scheduled STA that is in PS mode shall transition to the awake state at the start of an unannounced TWT SP of which it is a member. The STA may include other frames in the HE TB PPDU when other rules do not prohibit their inclusion, see 27.5.3 (UL MU operation)*(#AA)*

NOTE—A TWT scheduling AP(#6919) sets the bit in the TIM element of the Beacon frame that corresponds to the AID of the TWT scheduled STA to 1 to indicate that it expects the TWT scheduled STA to solicit available buffered BUs (see 11.2.2.8 (Receive operation for STAs in PS mode during the CP)).

A TWT scheduled STA should only send frames that satisfy the TWT flow identifier recommendations defined in Table 9.248l1 (TWT Flow Identifier field for a broadcast TWT element) during the corresponding TWT SP(s). Frames sent as a response to a Trigger frame are subject to further restrictions as defined in 27.5.3 (UL MU operation).

* TWT Information field

Change Figure 9-121c (TWT Information field format) as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0          B2 | B3 | B4 | B5                  B6 | B7 | B8       Bn |
|  | TWT Flow Identifier | Response Requested | Next TWT Request | Next TWT Subfield Size | ~~Reserved~~  All TWT(#12228) | Next TWT |
| Bits: | 3 | 1 | 1 | 2 | 1 | 0, 32, 48, or 64 |
| * TWT Information field format | | | | | | |

Change the 3rd paragraph as follows:

The TWT Flow Identifier subfield contains the TWT flow identifier for which TWT information is requested or being provided. The TWT Flow Identifier subfield is reserved if the All TWT subfield is 1.(#12228)

Insert the following before the last paragraph:

The All TWT subfield(#12228) is set to 1 by an HE STA to indicate that the TWT Information frame reschedules Broadcast TWTs as defined in 27.7.4 (Use of TWT Information frames). Otherwise, it is set to 0.

* TWT element

Replace Figure 9-589av (TWT element format) with the following:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | Element ID | Length | Control | TWT Parameter Information |
| Octets: | 1 | 1 | 1 | variable |
| * TWT element format | | | | |

Insert after the 1st paragraph, a new paragraph and two figures as follows:(#11123)

The TWT Parameter Information field contains a single Individual TWT Parameter Set field with format defined in Figure 9-589av1 (Individual TWT Parameter Set field format) when the Broadcast subfield in the Control field is 0 and contains one or more Broadcast TWT Parameter Set fields with format defined in Figure 9-589av2 (Broadcast TWT Parameter Set field format) when the Broadcast subfield of the Control field is 1. The number of Broadcast TWT Parameter Set fields present is determined by the values of the Implicit/Last Broadcast Parameter Set subfields of the Request Type fields.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | |  | |  | |  |  | |
|  | Request Type | Target Wake Time | TWT Group Assignment | | Nominal Minimum TWT Wake Duration | | TWT Wake Interval Mantissa | | TWT Channel | NDP Paging (optional) | |
| Octets: | 2 | 0 or 8 | 0, 3 or 9 | | 1 | | 2 | | 1 | 0 or 4 | |
| * Individual TWT Parameter Set field format | | | | | | | | | | | |
|  |  |  | |  | |  | |  | | |
|  | Request Type | Target Wake Time | | Nominal Minimum TWT Wake Duration | | TWT Wake Interval Mantissa | | Broadcast TWT Info | | |
| Octets: | 2 | 2 | | 1 | | 2 | | 2 | | |
| * Broadcast TWT Parameter Set field format | | | | | | | | | | |

Change Figure 9-589aw (Control field format) as follows.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ~~B1~~B0 | ~~B2~~B1 | B2              B3 | ~~B3~~B4 ~~B8~~B7 |
|  | NDP Paging Indicator | Responder PM Mode | Negotiation Type | Reserved |
| Bits: | 1 | 1 | 2 | ~~6~~4 |
| * Control field format | | | | |

Insert the following three paragraphs and table after the 5th paragraph (“The Responder PM Mode subfield...”):

The Negotiation Type subfield indicates whether the information included in the TWT element is for the negotiation of parameters of broadcast or individual TWT(s) or a Wake TBTT interval.(#11006, #11007) The MSB of the Negotiation Type subfield is the Broadcast field.(#11835)

If the Broadcast field of the Negotiation Type subfield is 1, then one or more broadcast TWT parameter sets are contained in the TWT element (see Figure 9-589av2 (Broadcast TWT Parameter Set field format)). (#12230)If the Broadcast field of the Negotiation Type subfield is 0, then only one Individual TWT parameter set is contained in the TWT element (see Figure 9-589av1 (Individual TWT Parameter Set field format)). An S1G STA sets the Negotiation Type subfield to 0.(#11007)(#11835)

The Negotiation Type subfield determines the interpretation of the Target Wake Time, TWT Wake Interval Mantissa and TWT Wake Interval Exponent subfields of the TWT element as defined in Table 9-262j1 (Interpretation of Negotiation Type subfield, Target Wake Time, TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields(#11007)).

|  |  |  |  |
| --- | --- | --- | --- |
| * Interpretation of Negotiation Type subfield, Target Wake Time, TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields(#11007) | | | |
| Negotiation Type subfield | Target Wake Time field | TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields | Description |
| 0 | A future Individual TWT SP start time | Interval between individual TWT SPs | Individual TWT negotiation between TWT requesting STA and TWT responding STA or individual TWT announcement by TWT responder. See 10.43 (Target wake time (TWT)), and 27.7.2 (Individual TWT agreements).(#12394)  The TWT element contains one individual TWT parameter set.(#11835) |
| 1 | Next Wake TBTT time | Interval between wake TBTTs | Wake TBTT and wake interval negotiation between TWT scheduled STA and TWT scheduling AP. See 27.7.4 (Use of TWT Information frames).  The TWT element contains one individual TWT parameter set.(#11835) |
| 2 | A future Broadcast TWT SP start time | Interval between broadcast TWT SPs | Provide broadcast TWT schedules to TWT scheduled STAs by including the TWT element in broadcast MGMT frames sent by TWT scheduling AP. See 27.7.3.2 (Rules for TWT scheduling AP).  The TWT element contains one or more broadcast TWT parameter sets.(#11835) |
| 3 | A future Broadcast TWT SP start time | Interval between broadcast TWT SPs | Manage memberships in broadcast TWT schedules by including the TWT element in individually addressed MGMT frames sent by either a TWT scheduled STA or a TWT scheduling AP. See 27.7.3 (Broadcast TWT operation).  The TWT element contains one or more broadcast TWT parameter sets.(#11835) |

Change Figure 9-589ax (Request Type field format) as follows:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 B3 | B4 | B5 | B6 | B7 B9 | B10 B14 | B15 |
|  | TWT  Request | TWT Setup Command | ~~Reserved~~  Trigger | Implicit / Last Broadcast Parameter Set | Flow  Type | TWT Flow Identifier/Broadcast TWT Recommendation | TWT Wake Interval Exponent | TWT Protection |
| Bits: | 1 | 3 | 1 | 1 | 1 | 3 | 5 | 1 |
| * Request Type field format | | | | | | | | |

Change the 6th and 7th paragraphs as follows:

A STA that transmits a TWT element with the TWT Request subfield equal to 1 is a TWT requesting STA or TWT scheduled STA. Otherwise, it is a TWT responding STA or TWT scheduling AP.

The TWT Setup Command subfield values indicate the type of TWT command ~~as shown in Table 9-262k~~. The use of the TWT Setup Command field for the negotiation of individual and broadcast TWT is described in Table 9-262k (TWT Setup Command field values). The entries in the table apply to cases where the Negotiation Type subfield is not 1(#11835). For TWT Setup Command field use when the Negotiation Type subfield is 1(#11835), see 27.7.4 (Use of TWT Information frames).

Change Table 9-262k (TWT Setup Command field values) as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| * TWT Setup Command field values | | | |
| TWT Setup Command field value | Command name | ~~Description when transmitted by a TWT requesting STA~~  Description | ~~Description when transmitted by a TWT responding STA~~ |
| 0 | Request TWT | ~~The Target Wake Time field of the TWT element contains 0s as the TWT responding STA specifies the target wake time value for this case, other TWT parameters\* are suggested by the TWT requesting STA in the TWT request.~~  A TWT requesting or TWT scheduled STA requests to join a TWT without specifying a target wake time.  This command is valid if the TWT Request field is equal to 1; otherwise the command is not applicable. | ~~N/A~~ |
| 1 | Suggest TWT | ~~TWT requesting STA includes a set of TWT parameters such that if the requested target wake time value and/or other TWT parameters cannot be accommodated, then the TWT setup might still be accepted.~~  A TWT requesting or TWT scheduled STA requests to join a TWT and specifies a suggested set of TWT parameters with the possibility that if the requested target wake time and/or other TWT parameters cannot be accommodated, then the TWT setup might still be accepted by the TWT requesting or TWT scheduled STA.  This command is valid if the TWT Request field is equal to 1; otherwise it is not applicable. | ~~N/A~~ |
| 2 | Demand TWT | ~~TWT requesting STA includes a set of TWT parameters such that if the requested target wake time value and/or other TWT parameters cannot be accommodated, then the TWT setup will be rejected.~~  A TWT requesting or TWT scheduled STA requests to join a TWT and specifies a demanded set of TWT parameters which, if not accommodated by the responding STA or TWT scheduling AP will cause the TWT requesting STA or TWT scheduled STA to reject the TWT setup.  This command is valid if the TWT Request field is equal to 1; otherwise it is not applicable. | ~~N/A~~ |
| 3 | TWT Grouping | ~~N/A~~  The TWT responding STA suggests TWT group parameters that are different from the suggested or demanded TWT parameters of the TWT requesting STA  This command is valid if the TWT Request field is 0, the Negotiation Type subfield has the value b00 and is sent by an S1G STA; otherwise not applicable.(#11367) | ~~TWT responding STA suggests TWT group parameters that are different from the suggested or demanded TWT parameters of the TWT requesting STA~~ |
| 4 | Accept TWT | ~~N/A~~  A TWT responding STA or TWT scheduling AP accepts the TWT request with the TWT parameters (see NOTE) indicated in the TWT element transmitted by the TWT responding STA or TWT scheduling AP.  This command is valid if the TWT Request field is 0; otherwise not applicable. | ~~TWT responding STA accepts the TWT request with the TWT parameters (See NOTE) indicated in the TWT element transmitted by the responding STA~~ |
| 5 | Alternate TWT | ~~N/A~~  A TWT responding STA or TWT scheduling AP(#11835) suggests TWT parameters that are different from those suggested by the TWT requesting STA or TWT scheduled STA.(#12402)  This command is valid if the TWT Request field is 0; otherwise not applicable. | ~~TWT responding STA suggests TWT parameters that are different from TWT requesting STA suggested or demanded TWT parameters~~ |
| 6 | Dictate TWT | ~~N/A~~  A TWT responding STA indicates TWT parameters that are different from TWT requesting STA suggested parameters.(#12400) | ~~TWT responding STA demands TWT parameters that are different from TWT requesting STA TWT suggested or demanded parameters~~ |
| 7 | Reject TWT | ~~N/A~~  A TWT responding STA rejects setup or a TWT scheduling STA terminates an existing broadcast TWT or a TWT scheduled STA terminates its membership in a broadcast TWT.(#11368, #12037, #12401) | ~~TWT responding STA rejects TWT setup~~ |
| NOTE—TWT Parameters are: TWT, Nominal Minimum Wake Duration, TWT Wake Interval and TWT Channel subfield values indicated in the element. The Trigger subfield value indicated in the element is also a TWT parameter for an HE STA. | | | |

Insert the following paragraph after the 7th paragraph (“The TWT Setup Command subfield...”):

The Trigger field indicates whether or not the TWT SP indicated by the TWT element includes Trigger frames or frames carrying a TRS Control subfield(#13136)(#12403) as defined in 27.7 (TWT operation)(#11987). The Trigger field is set to 1 to indicate that at least one Trigger frame is transmitted during the TWT SP. The Trigger field is set to 0 otherwise.

Change the 8th and 9th paragraphs as follows:

When transmitted by a TWT requesting STA, the Implicit / Last Broadcast Parameter Set subfield is set to 1 and the Broadcast subfield is set to 0 to request an implicit TWT.

When transmitted by a TWT requesting STA, the Implicit / Last Broadcast Parameter Set subfield is set to 0 and the Broadcast subfield is set to 0 to request an explicit TWT.

When the Broadcast subfield is equal to 1, the Implicit / Last Broadcast Parameter Set subfield is set to 0 to indicate that another broadcast TWT Parameter set follows this set. When the Broadcast subfield is equal to 1, the Implicit / Last Broadcast Parameter Set subfield is set to 1 to indicate that this is the last broadcast TWT Parameter set in the element.

Change the 11th paragraph as follows:

The TWT Flow Identifier/Broadcast TWT Recommendation subfield(#12405) contains a 3-bit value which identifies the specific information for this TWT request uniquely from other requests made between the same TWT requesting STA and TWT responding STA pair. For a TWT SP that is indicated in a TWT response transmission that is a broadcast TWT SP, the TWT Flow Identifier/Broadcast TWT Recommendation subfield(#12405) contains a value that indicates recommendations on the types of frames that are transmitted by TWT scheduled STAs and scheduling AP during the broadcast TWT SP, encoded according to Broadcast TWT Recommendation field for a broadcast TWT element. The TWT Flow Identifier/Broadcast TWT Recommendation is reserved when transmitted by a TWT scheduled STA.(#11369, #12404)

Insert a new table as follows:

|  |  |
| --- | --- |
| * Broadcast TWT Recommendation field(#12405) for a broadcast TWT element | |
| Broadcast TWT Recommendation field value | Description when transmitted in a broadcast TWT element |
| 0 | No constraints on the frames transmitted during a broadcast TWT SP. |
| 1 | Frames transmitted during a broadcast TWT SP by a TWT scheduled STA are recommended to be limited to solicited feedback and status:   * PS-Poll and QoS Null frames(#12313) * Feedback can be contained in the QoS Control field or in the HE variant HT Control field of the frame, if either is present (see (#12406)27.5.3 (UL MU operation), 27.8 (Operating mode indication), 27.13 (Link adaptation using the HLA Control subfield(#14137)), etc.) * Feedback in an HE TB NDP PPDU, if solicited by the AP (see 27.5.6 (NDP feedback report procedure))(#12313, #12409) * BQRs (see 27.5.2 (HE bandwidth query report operation for MU))(#11008, #12407) * Frames that are sent as part of a sounding feedback exchange (see 27.6 (HE sounding protocol)) * Management frames: Action or Action No Ack frames * Control response frames   Trigger frames transmitted by the TWT scheduling AP during the broadcast TWT SP do not contain RUs for random access (see 27.7.3.2 (Rules for TWT scheduling AP)), otherwise, there are no other restrictions on the frames transmitted by the TWT scheduling AP. |
| 2 | Frames transmitted during a broadcast TWT SP by a TWT scheduled STA are recommended to be limited to solicited status and feedback:   * PS-Poll and QoS Null frames * Feedback can be contained in the QoS Control field or in the HE variant HT Control field of the frame, if either is present (see (#12406)27.5.3 (UL MU operation), 27.8 (Operating mode indication), 27.13 (Link adaptation using the HLA Control subfield(#14137)), etc.) * BQRs (see 27.5.2 (HE bandwidth query report operation for MU))(#11008, #12407) * Frames that are sent as part of a sounding feedback exchange (see 27.6 (HE sounding protocol)) * Management frames: Action, Action No Ack frames or (Re)Association Request frames * Control response frames   Trigger frames transmitted by the TWT scheduling AP during the broadcast TWT SP contain at least one RU for random access (see 27.7.3.2 (Rules for TWT scheduling AP)), otherwise there are no restrictions on the frames transmitted by the TWT scheduling AP. |
| 3 | No constraints on the frames transmitted during a broadcast TWT SP except that the AP transmits a TIM frame or a FILS Discovery frame including a TIM element at the beginning of each TWT SP (see 27.14.3.2 (AP operation for opportunistic power save)). |
| 4-7 | Reserved |

Change the 12th and 13th paragraphs as follows:

In a TWT element transmitted by a TWT requesting or TWT scheduled STA, the TWT wake interval is equal to the average time that the ~~TWT requesting~~ STA expects to elapse between successive TWT SPs start times (see Table 9-262j1 (Interpretation of Negotiation Type subfield, Target Wake Time, TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields(#11007))). In a TWT element transmitted by a TWT responding STA or TWT scheduling AP, the TWT wake interval is equal to the average time that the ~~TWT responding~~ STA expects to elapse between successive TWT SPs start times(#12035). In a TWT element contained in a TWT request that is sent by the scheduled STA to negotiate its wake intervals, the TWT wake interval indicates the value of the wake interval (see 27.7.4 (Use of TWT Information frames)).(#12410) The TWT Wake Interval Exponent subfield is set to the value of the exponent of the TWT wake interval value in microseconds, base 2. The TWT wake interval of the requesting STA is equal to (TWT Wake Interval Mantissa) × 2(TWT Wake Interval Exponent).

When transmitted by a TWT requesting STA or a TWT scheduled STA and the TWT Setup Command subfield contains a value corresponding to the command "Suggest TWT" or "Demand TWT", the Target Wake Time field contains ~~a positive~~ an unsigned integer ~~which~~ that corresponds to a TSF time at which the STA requests to wake~~, or a value of zero when the TWT Setup Command subfield contains the value corresponding to the command “Request TWT”~~. When transmitted by a TWT requesting STA or a TWT scheduled STA and the TWT Setup Command subfield contains the value corresponding to the command "Request TWT", the Target Wake Time field contains the value 0. The Target Wake Time field is 8 octets when the Broadcast field is 0; otherwise it is 2 octets with the lowest bit of the 2 octets corresponding to bit 10 of the relevant TSF value. When a TWT responding STA with dot11TWTGroupingSupport equal to 0 transmits a TWT element to the TWT requesting STA, the TWT element contains a value in the Target Wake Time field ~~which~~ that corresponds to a TSF time at which the TWT responding STA requests the TWT requesting STA to wake for the corresponding TWT SP and it does not contain the TWT Group Assignment field.(#12412, #12413)

Insert the following paragraphs and figure after paragraph 21 (“The TWT Wake Interval Mantissa...”):

(#11123)The Broadcast TWT Info subfield is defined in Figure 9-589ay1 (Broadcast TWT Info subfield format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0                       B2 | B3                       B7 | B8                     B15 |
|  | Broadcast TWT Persistence Exponent(#11005) | Broadcast TWT ID | Broadcast TWT Persistence Mantissa(#11005) |
| Bits: | 3 | 5 | 8 |
| * Broadcast TWT Info subfield format | | | |

The Broadcast TWT Persistence Mantissa subfield and Broadcast TWT Persistence Exponent subfield together indicate the number of TBTTs during which the Broadcast TWT SPs corresponding to this broadcast TWT Parameter set are present. The number of beacon intervals during which the Broadcast TWT SPs are present is equal to the value in the Broadcast TWT Persistence Mantissa subfield plus 1 then multiplied by 2Broadcast TWT Persistence Exponent subfield, except that the value 255 in the Broadcast Persistence Mantissa subfield indicates that the Broadcast TWT SPs are present until explicitly terminated.(#11005, #12036)

Within a TWT element that includes a TWT setup command value of Request TWT, Suggest TWT or Demand TWT, the Broadcast TWT ID, if present, indicates a specific Broadcast TWT in which the transmitting STA is requesting to participate. Within a TWT element that includes a TWT setup command value of Accept TWT, Alternate TWT, Dictate TWT or Reject TWT, the Broadcast TWT ID, if present, indicates a specific Broadcast TWT for which the transmitting STA is providing TWT parameters. Within a TWT element that includes a TWT setup command value of TWT Grouping, the Broadcast subfield is 0 and the Broadcast TWT ID~~,~~ is not present. The value 0 in the Broadcast TWT ID subfield indicates the (#12084)broadcast TWT whose membership corresponds to all STAs that are members of the BSS corresponding to the BSSID of the Management frame(#12597) carrying the TWT element.

Change the 22nd and subsequent two paragraphs as follows:

When transmitted by a TWT requesting STA that is neither an S1G STA nor an HE STA with dot11HESubchannelSelectiveTransmissionImplemented equal to true, the TWT Channel field is reserved. When transmitted by a TWT requesting STA that is either an S1G STA or an HE STA with dot11HESubchannelSelectiveTransmissionImplemented equal to true, the TWT Channel field contains a bitmap indicating which channel the STA requests to use as a temporary primary channel during a TWT SP. When transmitted by a TWT responding STA that is either an S1G STA or an HE STA with dot11HESubchannelSelectiveTransmissionImplemented equal to true, the TWT Channel field contains a bitmap indicating which channel the TWT requesting STA is allowed to use as a temporary channel during the TWT SP. Each bit in the bitmap corresponds to one minimum width channel for the band in which the TWT responding STA's associated BSS is currently operating, with the least significant bit corresponding to the lowest numbered channel of the operating channels of the BSS. In an S1G BSS, the ~~The~~ minimum width channel is equal to the SST Channel Unit field of the SST Operation element if such an element has been previously received or is equal to 1 MHz for a BSS with a BSS primary channel width of 1 MHz and 2 MHz for a BSS with a BSS primary channel width of 2 MHz if no such element has been previously received from the AP to which the SST STA is associated. In an HE BSS, the minimum width channel is equal to 20 MHz. A value of 1 in a bit position in the bitmap transmitted by a TWT requesting STA means that operation with that channel as the primary channel is requested during a TWT SP. A value of 1 in a bit position in the bitmap transmitted by a TWT responding STA means that operation with that channel as the primary channel is allowed during the TWT SP. In an HE BSS, only one bit of the bitmap can have a value of 1. The TWT Channel field is not present when the Broadcast field has the value 1.

~~A TWT requesting STA sets the TWT Protection subfield to 1 to request the TWT responding STA to provide protection of the set of TWT SPs corresponding to the requested TWT flow identifier by allocating RAW(s) that restrict access to the medium during the TWT SP(s) for that (those) TWTs. A TWT requesting STA sets the TWT Protection subfield to 0 if TWT protection by RAW allocation is not requested for the corresponding TWT(s).~~

A TWT requesting STA sets the TWT Protection subfield to 1 to request the TWT responding STA to provide protection of the set of TWT SPs corresponding to the requested TWT flow identifier by:

* Allocating RAW(s) that restrict access to the medium during the TWT SP(s) for the TWTs that are set up within an S1G BSS
* Enabling NAV protection during the TWT SP(s) for the TWTs that are set up within an HE BSS

A TWT requesting STA sets the TWT Protection subfield to 0 if TWT protection is not requested for the corresponding TWT(s).

A TWT scheduled STA sets the TWT Protection subfield to 0.

~~When transmitted by a TWT responding STA that is an AP, the TWT Protection subfield indicates whether the TWT SP(s) identified in the TWT element will be protected. A TWT responding STA sets the TWT Protection subfield to 1 to indicate that the TWT SP(s) corresponding to the TWT flow identifier(s) of the TWT element will be protected by allocating RAW(s) that restrict access to the medium during the TWT SP(s) for that (those) TWT(s). A TWT responding STA sets the TWT Protection subfield to 0 to indicate that the TWT SP(s) identified in the TWT element might not be protected from TIM STAs by allocating RAW(s).~~

When transmitted by a TWT responding STA or TWT scheduling AP, the TWT Protection subfield indicates whether the TWT SP(s) identified in the TWT element will be protected. A TWT responding STA or TWT scheduling AP sets the TWT Protection subfield to 1 to indicate that the TWT SP(s) corresponding to the TWT flow identifier(s) of the TWT element will be protected by:

* Allocating RAW(s) that restrict access to the medium during the TWT SP(s) for the TWTs where the responding STA or scheduling STA is an S1G STA.
* Enabling NAV protection during the TWT SP(s) for the TWTs where the responding STA or scheduling AP is an HE STA.

A TWT responding STA or TWT scheduling AP sets the TWT Protection subfield to 0 to indicate that the TWT SP(s) identified in the TWT element might not be protected.

* Target wake time (TWT)
* TWT overview

Change the 2nd paragraph as follows:

STAs that request a TWT agreement are called TWT requesting STAs and the STAs that respond to their requests are TWT responding STAs. A TWT requesting STA is assigned specific times to wake and exchange frames with the TWT responding STA.(#11027, #11375) A TWT requesting STA communicates wake scheduling information to its TWT responding STA and the TWT responding STA devises a schedule and delivers TWT values to the TWT requesting STA when a TWT agreement has been established between them. When explicit TWT is employed, a TWT requesting STA wakes and performs a frame exchange and receives the next TWT information in a response from the TWT responding STA as described in 10.43.3 (Explicit TWT operation)(#13505). When implicit TWT is used, the TWT requesting STA calculates the Next TWT by adding a fixed value to the current TWT value as described in 10.43.4 (Implicit TWT operation)(#13505). STAs need not be made aware of the TWT values of other STAs. A TWT requesting STA and a TWT responding STA shall set the Negotiation Type subfield to 0 in the TWT element of transmitted frames containing the TWT element, except when the STAs are HE STAs. Additional TWT setup exchanges between HE STAs for individual TWT operation are defined in 27.7 (TWT operation).(#11376)

Insert new paragraphs and table as follows after the 9th paragraph:

The result of an exchange of TWT Setup frames between a TWT requesting STA and a TWT responding STA is defined in Table 10-19a (TWT setup exchange command interpretation). In general, the meaning of Request TWT is that the transmitting STA does not provide a set of TWT parameters for a TWT agreement, leaving the choice of parameters to the responding STA, “Suggest TWT” indicates that the transmitting STA offers a set of preferred TWT parameters for a TWT agreement but might accept alternative TWT parameters that the responding STA indicates and “Demand TWT” indicates that the transmitting STA will currently accept only the indicated TWT parameters for a TWT agreement. When transmitted by a responding STA, “Accept TWT” indicates that the responding STA has initiated a TWT agreement with the given parameters, Alternate TWT indicates a counter-offer of TWT parameters (although alternative TWT parameters might be accepted as well) without the creation of a TWT agreement, “Dictate TWT” indicates that no TWT agreement is created, but one is likely to be accepted only if the requesting STA transmits a new TWT setup request with the indicated TWT parameters (i.e., no other TWT parameters will be accepted), and "Reject TWT" transmitted by a responding STA as part of a negotiation for a new TWT agreement is used to indicate that the negotiation has ended in failure to create a new TWT agreement.

|  |  |  |
| --- | --- | --- |
| * TWT setup exchange command interpretation | | |
| Initiating frame: TWT Setup Command field value within a TWT Setup frame transmitted from a first STA to a second STA | Response frame: TWT Setup Command field value within a TWT Setup frame transmitted from the second STA to the first STA | TWT condition after the completion of the exchange |
| Request TWT or Suggest TWT or Demand TWT | No frame transmitted | No new individual TWT agreement exists with the TWT flow identifier corresponding to the TWT flow identifier in the initiating frame. No new individual TWT agreement exists. |
| Demand TWT | Accept TWT | An individual TWT agreement exists that uses the TWT parameters identified in the initiating frame. The TWT parameters in the response frame match the TWT parameters of the initiating frame. |
| Suggest TWT or Request TWT | Accept TWT | An individual TWT agreement exists and that uses the TWT parameters identified in the response frame. |
| Demand TWT or Suggest TWT | Alternate TWT(#12453) | No individual TWT agreement exists with the associated TWT flow identifier. The responder is offering an alternative set of parameters vs. those indicated in the initiating frame. The requesting STA can send a new request with any set of TWT parameters and the responder might create an individual TWT agreement using those parameters. |
| Demand TWT or Suggest TWT(#12453) | Dictate TWT | No individual TWT agreement exists with the associated TWT flow identifier. The responder offers an alternative set of parameters vs. those indicated in the TWT request. By selecting “Dictate TWT”, the responder indicates that it is not willing to accept any other TWT parameters for the requesting STA at this time. The requesting STA can send a new request, but will only receive an Accept TWT if it uses the dictated TWT parameters. |
| Request TWT or Suggest TWT or Demand TWT | Reject TWT | No individual TWT agreement exists with the associated TWT flow identifier. The responding STA will not create any new individual TWT agreement with the requester at this time. |
| NOTE—Request frame settings not listed in the table are not allowed. | | |

(#11376)Change the last paragraph of 10.43.1 as follows:(#11837)

A TWT requesting STA indicates which single channel it desires to use as a temporary primary channel during a TWT SP by setting a single bit to 1 within the TWT Channel field of the TWT element, according to the mapping described for that field. A TWT responding STA indicates which single channel the TWT requesting STA is permitted to use as a temporary primary channel during a TWT SP by setting a single bit to 1 within the TWT Channel field of the TWT element, according to the mapping described for that field. In an S1G BSS, during ~~During~~ a TWT SP, access to a channel that is not the primary channel of the BSS shall be performed according to the procedure described in 10.48. In an HE BSS, during a trigger-enabled TWT SP, access to a channel that is not the primary channel of the BSS shall be performed according to the procedure described in 27.7.7 (HE subchannel selective transmission operation).

* Use of TWT Information frames
* General

An HE STA may transmit a TWT Information frame to its peer STA during an individual TWT session, broadcast TWT session, or at any time as defined in 27.7.4.2 (TWT information for individual TWT), 27.7.4.3 (TWT information for broadcast TWT) and 27.7.4.4 (TWT information for flexible TWT), respectively.

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:

* A nonzero value in the Next TWT subfield when the frame is transmitted by a TWT responding STA, a TWT scheduling AP, or by any HE STA to a peer STA that supports TWT.
* The value of the Next TWT shall be selected from existing TWT values for a TWT session if the Flexible TWT Schedule Support field in the HE Capabilities element received from the peer STA is 0.(#13792)
* The Next TWT may contain any nonzero value if Flexible TWT Schedule Support field in the HE Capabilities element received from the peer STA is 1.(#13792)
* A Next TWT subfield that is present when the frame is transmitted by a TWT requesting STA, a TWT scheduled STA, or any HE STA to a peer STA that supports TWT.
* The Next TWT indicates the earliest TWT at which the TWT session is resumed and shall be selected from existing TWT values for that TWT session if the Flexible TWT Schedule Support field in the HE Capabilities element received from the peer STA is 0.(#13792)
* The Next TWT may contain any nonzero value if Flexible TWT Schedule Support field in the HE Capabilities element received from the peer STA is 1.(#13792)  
  NOTE—In such case, the TWT requesting STA or TWT scheduled STA or peer STA that transmitted the TWT Information frame preserves the PM mode from the time it sent the TWT Information frame to the time it is expected to wake up.
* A Next TWT subfield that is not present when the frame is transmitted by a TWT requesting STA or a TWT scheduled STA to indicate suspension of the TWT session.

The TWT Information frame may have the All TWT subfield set to 1 to indicate suspend, or resume all broadcast TWT sessions (see 27.7.4.3 (TWT information for broadcast TWT)), all individual TWT sessions (see 27.7.4.2 (TWT information for individual TWT)), and additionally provide flexible TWTs (see 27.7.4.4 (TWT information for flexible TWT)).(#12228, #11351, #11853)

* TWT information for individual TWT

An HE STA that has an individual TWT agreement may transmit a TWT Information frame to the STA with which it has an agreement. The HE STA sets the fields of the TWT Information frame as defined in Table 27.7.4.1 (General).

A TWT requesting STA that receives a TWT Information frame follows the rules defined in 10.43.4 (Implicit TWT operation).

A TWT requesting STA that receives an acknowledgment in response to a transmitted(#12538) TWT Information frame that:

* Does not contain a Next TWT field shall consider that TWT session suspended, and can follow other individual TWT sessions, the procedure in 27.7.3 (Broadcast TWT operation), or the default PS procedure defined in 11.2 (Power management) until the TWT session is resumed.
* Contains a Next TWT field shall resume the corresponding TWT session, starting from the value indicated in the Next TWT field of the transmitted TWT Information frame.

NOTE—The TWT Flow Identifier, together with the MAC addresses of the TWT requesting STA and TWT Responding STA identifies the TWT agreement for which the TWT Information frame is sent (see 10.43.1 (TWT overview)).

If the TWT Information frame contains an All TWT subfield equal to 1 then the above rules apply to all individual TWT sessions, except that the resumptions of the respective TWTs occur not earlier than the Next TWT value contained in the TWT Information frame.(#12228)

A TWT requesting STA that is in PS mode and that transmits a TWT Information frame to a peer STA may transition to doze state after receiving the acknowledgment even if it has previously transmitted a PS-Poll or U-APSD trigger frame(#13321) and has not yet received the expected frames from the AP in response and shall resume TWT operation for the corresponding TWT session at the specified TWT indicated (if any) in the TWT Information frame. A TWT requesting STA that is in PS mode and that receives a TWT Information frame from a peer STA may go to doze state after transmitting the acknowledgment even if it has previously transmitted a PS-Poll or U-APSD trigger frame(#13322) and has not yet received the expected frames from the AP in response and shall resume TWT operation for the corresponding TWT session at the specified TWT indicated (if any) in the TWT Information frame.(#11350)

* TWT information for broadcast TWT

An HE STA that is a TWT scheduling AP may transmit a TWT Information frame to any of the members of a broadcast TWT schedule. An HE STA that is a TWT scheduled STA may transmit a TWT Information frame to the TWT scheduling AP corresponding to a broadcast TWT schedule established by that STA. The HE STA sets the fields of the TWT Information frame as defined in 27.7.4.1 (General).

A TWT scheduled STA that receives a TWT Information frame that contains an All TWT subfield equal to 1 follows the rules defined in 27.7.3.3 (Rules for TWT scheduled STA), except that the TWT scheduled STA shall consider all the broadcast TWTs as resumed in their respective broadcast TWTs, which occur not earlier than the Next TWT value contained in the received TWT Information frame.(#11351, #11853)

A TWT scheduled STA that receives an acknowledgment in response to a transmitted(#12538) TWT Information frame that contains an All TWT subfield equal to 1 and:

* Does not contain a Next TWT field shall consider all broadcast TWT sessions suspended, and can follow the default PS procedure defined in 11.2 (Power management) until the broadcast TWT sessions are resumed.
* Does contain a Next TWT field shall resume all broadcast TWT sessions in their respective broadcast TWT schedules, which occur not earlier than from the value indicated in the next TWT value contained in the transmitted TWT Information frame.(#11351, #11853)

NOTE—TWT suspension and resumption as indicated by a TWT Information frame with the All TWT subfield equal to 1 applies to all broadcast TWT sessions of the TWT scheduling AP.

A TWT scheduled STA that is in PS mode and that transmits a TWT Information frame to a peer STA may transition to doze state after receiving the acknowledgment, even if it has previously transmitted a PS-Poll or U-APSD trigger frame(#13323) and has not yet received the expected frames from the TWT scheduling AP in response and shall resume TWT operation for the corresponding TWT session at the specified TWT indicated (if any) in the TWT Information frame. A TWT scheduled STA that is in PS mode and that receives a TWT Information frame from a TWT scheduling AP may transition to doze state after transmitting the acknowledgment, even if it has previously transmitted a PS-Poll or U-APSD trigger frame(#13324) and has not yet received the expected frames from the TWT scheduling AP in response and shall resume TWT operation for the corresponding TWT session at the specified TWT indicated (if any) in the TWT Information frame.(#11350)

* TWT information for flexible TWT

An HE STA may transmit a TWT Information frame to its peer STA at any time (i.e., without participating in any TWT sessions) if the peer STA has set the Flexible TWT Schedule Support field of the HE Capabilities it transmits. An HE STA may transmit a TWT Information frame to a TWT scheduling AP. The HE STA sets the fields of the TWT Information frame as defined in 27.7.4.1 (General).

NOTE—When the TWT Information frame has the All TWT field equal to 1 then the TWTs are resumed as described in 27.7.4.2 (TWT information for individual TWT) and 27.7.4.3 (TWT information for broadcast TWT).(#11351, #11853)

A non-AP HE STA that transmits a TWT Information frame with All TWT subfield equal to 1 to a peer STA may go to doze state after receiving the acknowledgment and shall be in the awake state at the specified TWT indicated in the TWT Information frame. A non-AP HE STA that receives a TWT Information frame with All TWT subfield equal to 1 from a peer STA may go to doze state after transmitting the acknowledgment and shall be in the awake state at the specified TWT indicated in the TWT Information frame.

* Power save(#11955) 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.(#12539)

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.(#12539)

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(#Ed) and has not yet received the expected frames from the AP in response.(#12539)

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(#Ed) and has not yet received the expected frames from the AP in response.

(#13793)A TWT requesting STA or a TWT scheduled STA shall classify any of the following events as a TWT SP termination event:

* The successful exchange of a TWT Information frame with the TWT responding STA or the TWT scheduling AP (see 27.7.4 (Use of TWT Information frames)).(#13793)
* The transmission by the TWT requesting STA or TWT scheduled STA of an acknowledgment(#11208) in response to an individually addressed 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(#11208) in response to an individually addressed frame sent by the TWT responding STA or TWT scheduling AP, respectively with the More Data field equal to 0 when the frame does not contain an EOSP subfield.
* The reception of a frame sent by the TWT responding STA or TWT scheduling AP that does not solicit an immediate response and that had an EOSP subfield present with a value equal to 1.
* The reception of an individually addressed frame sent by the TWT responding STA or TWT scheduling AP that does not solicit an immediate response and that had no EOSP subfield present but had 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 intended for 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.(#11854, #13927)

The classification of a More Data field equal to 0 in an Ack, BlockAck and 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)).

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 termination event causes all of the overlapping TWT SPs to terminate.

(#11854, #13927)NOTE 2—A Trigger frame, sent by the TWT scheduling AP, is defined as intended for the TWT scheduled STA when the Trigger frame contains the AID of the STA in one of its Per User Info fields (see 27.5.3 (UL MU operation)), and can have in the TA field the MAC address of the AP or the(#11036, #13794) transmitted BSSID under the conditions defined in 27.5.3.2.3 (Allowed settings of the Trigger frame fields and TRS Control subfield(#14137)). Otherwise, the Trigger frame is not intended for the STA. If the Trigger frame contains one or more RA-RUs(#11033) for which the STA can gain access according to 27.5.5 (UL OFDMA-based random access (UORA)) then the STA can follow the rules defined in 27.14.2 (Power save with UORA) to determine an early TWT SP termination event.

* Negotiation of wake TBTT and wake interval

A TWT scheduled STA that intends to operate in power save mode (see 11.2.2.2 (STA Power Management modes)) may transmit a TWT request frame to the TWT scheduling AP 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 frame 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.(#12528, #11849)

A TWT scheduling AP that receives a TWT request frame from a STA whose value of the Negotiation Type subfield is 1 shall respond with a TWT response frame that contains either Accept TWT, Alternate TWT,(#12095) 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(#12528, 11849)

After successfully completing the negotiation, the TWT scheduled STA 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 TWT scheduled STA shall be in the awake state to listen to Beacon frames transmitted at negotiated wake TBTTs and shall operate as described in 27.7.3.3 (Rules for TWT scheduled STA).

After receiving the Beacon frame at or after TBTT, the TWT scheduled STA may go to doze state until the next wake TBTT if no other condition requires the STA to remain awake. The TWT scheduled STA may go to doze state after AdjustedMinimumTBTTWakeDuration(#12528, #11849) time has elapsed from the TBTT start time if no Beacon frame is received.

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.(#13040, #12529)

Table 27-7 (Wake TBTT negotiation exchanges)(#12096) summarizes the interactions between devices that negotiate a Wake TBTT agreement.

|  |  |  |
| --- | --- | --- |
| * Wake TBTT negotiation exchanges | | |
| Initiating frame | Response frame |  |
| TWT Setup Command field value within a TWT Setup frame transmitted from a first STA to a second STA with the Negotiation Type subfield set to 1(18/373r0) | TWT Setup Command field value within a TWT Setup frame transmitted from the second STA to the first STA Negotiation Type subfield set to 1(18/373r0) | 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 responder is offering an alternative set of parameters vs. those indicated in the initiating frame. The TWT scheduled STA 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 TWT scheduled STA 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.(#12530, #12246) |
| Reject TWT | None | An existing Wake TBTT agreement between the initiator and the responder has been terminated. |

* HE subchannel selective transmission operation

(#11837)A TWT requesting STA and a TWT responding STA may set up a TWT for enabling frame exchanges on a non-primary 20 MHz subchannel. In which case, the TWT requesting STA and the TWT responding STA follow the rules described in this subclause.

An HE STA that implements the HE subchannel selective transmission operation described in this subclause sets dot11HESubchannelSelectiveTransmissionImplemented to true.

An HE AP STA with dot11HESubchannelSelectiveTransmissionImplemented true shall set the HE Subchannel Selective Transmission Support field in the HE Capabilities element it transmits to 1. A 20 MHz-only non-AP HE STA with dot11HESubchannelSelectiveTransmissionImplemented true shall set the HE Subchannel Selective Transmission Support field in the HE Capabilities element it transmits to 1. Otherwise, a non-AP HE STA shall set the HE Subchannel Selective Transmission Support field in the HE Capabilities element it transmits to 0.

A TWT requesting STA with dot11HESubchannelSelectiveTransmissionImplemented equal to true may set one bit in the TWT Channel field of the TWT request to 1 to request a secondary channel that is permitted for the RU allocation, when a TWT responding STA has set the HE Subchannel Selective Transmission Support field to 1 in the HE Capabilities element it transmits. The secondary channel requested in the TWT request shall not be outside of the BSS bandwidth.

After receiving the TWT request of which the TWT Channel field has a nonzero bit value, a TWT responding STA with dot11HESubchannelSelectiveTransmissionImplemented equal to true may set one bit in the TWT Channel field of the TWT response frame to 1 to indicate a secondary channel that is permitted for the RU allocation. The secondary channel indicated in the TWT response shall not be outside of the BSS bandwidth.

During the negotiated trigger-enabled TWT SPs, an HE AP that is under the TWT agreement shall allocate an RU in a secondary channel specified in the TWT Channel field of the TWT response and follow the RU restriction rules defined in 28.3.2.8 (RU restrictions for 20 MHz operation) when allocating an RU in an HE MU PPDU or for an HE TB PPDU to a non-AP STA that is under the TWT agreement.

During the negotiated trigger-enabled TWT SPs, the non-AP STA that is under the TWT agreement shall move to a secondary channel specified in the TWT Channel field of the TWT response. The non-AP STA shall not access the medium on the secondary channel using a DCF and EDCAF. After moving into a new operation channel, the non-AP STA in order to transmit shall perform CCA until a frame is detected by which it can set its NAV, or until a period of time equal to the *NAVSyncDelay* has transpired, whichever is earlier. A STA that receives a PPDU on the secondary channel shall update its NAV according to 27.2.4 (Updating two NAVs).

The negotiated trigger-enabled TWT SPs shall not overlap with the TBTTs at which the TWT responding STA schedules for transmission DTIM Beacon frames. The TWT responding STA shall ensure that all negotiated trigger-enabled TWT SPs that are overlapping in time use the same secondary channel.

An HE STA with dot11HESubchannelSelectiveTransmissionImplemented true may include a Channel Switch Timing element in (Re)Association Request frames to indicate its channel switch time between the primary and secondary channel. The channel switch time informs the AP of the duration of time that the non-AP STA might not be available to receive frames before the TWT starting time and after the end of the trigger-enabled TWT SP.

NOTE—An HE STA in the PS mode is not required to move to a primary channel after the end of the trigger-enabled TWT SP.