IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | CR TWT IE | | | | | | Date: 2017-12-26 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Matthew Fischer | Broadcom |  |  | [Matthew.fischer@broadcom.com](mailto:Matthew.fischer@broadcom.com) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

Comment resolution with proposed changes to TGax D2.0 for CIDs from LB230 related to the TWT Information Element.

The CID list is:

11005, 11006, 11007, 11008, 11123, 11367, 11368, 11369, 11700, 11863, 11987, 12033, 12035, 12036, 12037, 12038, 12039, 12040, 12084, 12230, 12313, 12387, 12394, 12395, 12396, 12397, 12398, 12399, 12400, 12401, 12402, 12403, 12404, 12405, 12406, 12407, 12408, 12409, 12410, 12411, 12412, 12413, 13000

The proposed changes on this document are based on TGax Draft 2.0.

**REVISION NOTES:**

**R0**:

initial

**R1**:

CID 12040 – previously had no resolution, now added a reject

Adjusted doc references

**R2**:

CID 12306, 12313 – previously had no resolution, now added revise, including changes to specify Broadcast TWT for NDP FB collection as part of TWT Flow ID encoding

Adjusted doc references

**R3**:

CID 11367 – some text was marked with this CID that should not have been marked

Broadcast TWT Cosntraint field renamed to Broadcast TWT Recommendation field

Target Wake Time field description – Had previously included a sentence to parallel the one for requesting/responding using scheduled/scheduling STA for the value of this field when dot11TWTGrouping is true, but this can never happen for broadcast, so this sentence is deleted

Adjusted doc references

**R4**:

CID 11005 – Broadcast TWT Persistence field – added 8 more bits, now can specify much longer intervals using separate mantissa and exponent fields

Adjusted doc references

**R5**:

CID 12306 – this CID and associated proposed draft text changes are removed – this CID had including changes to specify Broadcast TWT for NDP FB collection as part of TWT Flow ID encoding

Adjusted doc references

**R6**:

CID 11367 – the change in r5 used the old bit field name of Broadcast, but needed to be renamed Negotiation Type = 00

In row 5 and 6 of command setup table, “or demanded” is removed because the sequence is not allowed

Modified Broadcast TWT Recommendation table

Modified TWT Flow ID table

Adjusted doc references

**END OF REVISION NOTES**

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.***

**CIDs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **11005** | Abhishek Patil | 9.4.2.200 | 131.01 | The procedure for indicating validity of a TWT schedule is not well thought through. The mechansim uses 3-bits which can only signal up to 6 beacon intervals (value 7 is reserved). This is too short and STAs in extended sleep (e.g., long Listen interval or Negotiated Wake-TBTT) can easily miss an announcement of an upcoming change (Setup Command = Alternate) or termination (Setup Command = Reject). Define an encoding scheme so the field can represent larger intervals. Since 3-bits doesn't offer many combinations, increase the size of the field (to perhaps 1 octet). Have the update interval to be DTIM instead of a Beacon interval. | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11005, see also CID 12036 |
| **11006** | Abhishek Patil | 9.4.2.200 | 125.15 | Add Wake TBTT Negotiation = 0 (along with Broadcast = 0) to indicate an Individual TWT | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11006 |
| **11007** | Abhishek Patil | 9.4.2.200 | 126.16 | The name 'Wake TBTT Negotiation' is misleading as the field is used in conjunction with Broadcast subfield to determine if the frame carrying the element is individually addressed (as in negotiation) or broadcasted (as in advertisement for all). Either rename the field to something appropriate (which captures both functionalities) or consolidate the two fields to a single 2-bit field (with appropriate name) and update table 9-262j to show all 4 combinations. Also update section 27.7 | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11007 |
| **11008** | Abhishek Patil | 9.4.2.200 | 129.42 | Assuming support on both sides, BQR can be a valid response when TWT Flow Identifier is 1. Same comment applies to the case where TWT Flow Identifier = 2 (P130L9) | Include reference to section 27.5.2 for TWT Flow ID = 1 & 2. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11008 |
| **11123** | Adrian Stephens | 9.4.2.200 | 124.56 | "when the Broadcast subfield is 1" -- this repeated condition begs for a name. | Describe format in two named variants and define condition that selects the variants. Perhaps as new 9.4.2.200.1 and 9.4.2.200.2 subclauses. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11123 |
| **11367** | Bibhu Mohanty | 9.4.2.200 | 128.12 | Since row 3 (TWT Grouping) applies only for an S1G device, add Broadcast = 0 as another condition. | Revise the text in the 'Description' column for row 3 as: This command is valid if the TWT Request field is 0, Broadcast subfield is 0 and Wake TBTT Negotiation subfield is 0 and is sent by an S1G STA; otherwise not applicable." | Accept |
| **11368** | Bibhu Mohanty | 9.4.2.200 | 128.39 | Rows 6 & 7 are valid for an S1G STA and (under certain conditions) for an HE STA. They should not be N/A - provide a short description along with reference to section 10.43.1 and Table 27.4 | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11368 |
| **11369** | Bibhu Mohanty | 9.4.2.200 | 129.19 | Wake TBTT procedure as described in section 27.7.3.4 does not make any reference to Flow Identifier. Remove the exception from the sentence to indicate that the field is reserved when the element is transmitted by a non-AP HE STA | Change the sentence "The TWT Flow Identifier is reserved when transmitted by a TWT scheduled STA except when used as defined in 27.7.3.4 (Negotiation of wake TBTT and wake interval)." to "The TWT Flow Identifier is reserved when the element is transmitted by a non-AP HE STA." | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11369 |
| **11700** | Evgeny Khorov | 9.4.2.200 | 129.58 | Replace ".." with "." | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11700 |
| **11863** | Guoqing Li | 9.4.2.200 | 131.33 | It is unreasonable to ask all STAs to be awake during the Broadcast TWT periods when TWT ID=0 because the STA may be in doze or doing other activities and cannot be available. Either change this to be dependent on OPS operation, i.e., only when AP/STA supports OPS, then allows it, or this Broadcast TWT has to be announced. | Either change this to be dependent on OPS operation, i.e., only when AP/STA supports OPS, then allows it, or this Broadcast TWT has to be announced. | Revise – TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 11863 |
| **11987** | James Yee | 9.4.2.200 | 128.56 | The referenced clause 10.43 does not describe Trigger field related behavior. Should refer to 27.7 instead. | As suggested. | Accept |
| **12033** | Jarkko Kneckt | 9.4.2.200 | 125.06 | The Control field format should start from B0, not from B1. The following bit numbers should be adjusted accordingly. | As in comment. | Accept |
| **12035** | Jarkko Kneckt | 9.4.2.200 | 130.43 | The TWT interval should be the time between successive TWT SP start times. The time between successive TWT SPs may variate. | Change to:" ... STA expects to elapse between succesive TWT SP start times." | Accept |
| **12036** | Jarkko Kneckt | 9.4.2.200 | 131.17 | The interval between broadcast TWT SPs may be longer than a beacon interval. When a TWT SP interval is longer than a beacon interval, no broadcast TWT SP may be present in the beacon interval. This may cause two issues: 1. The wording suggests that there is a TWT SP in a beacon interval and there may not be any TWT SP. 2. If the TWT Persistent field is implemented poorly, the TWT Persistent field may indicate that TWT is ongoing, but because of hte timing parameters, the TWT may not have any TWT SP. | Please clarify how Broadcast TWT Persistent field is set, if no TWT SP will be present in the coming/current beacon intervals. Please add text to explain that if TWT persistent field is larger than 0, then there will be at least one TWT SP before the TWT Persistent field reaches value 0. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12036, which generally indicate that the the persistence field meaning depends on the comparison of the TWT SP interval against the beacon interval. |
| **12037** | Jarkko Kneckt | 9.4.2.200 | 128.44 | The Table 9-262k shows that Reject TWT is N/A. However, this value is present in other tables and the value is needed to signal the termination of the BC TWT. | Please add description of Reject TWT to Table 9-262k. | Accept |
| **12038** | Jarkko Kneckt | 9.4.2.200 | 129.38 | Please clarify whether AP allocates RUs for OFDMA random access if an AP has a TWT SP with TWT Flow Identifier value 1 tthat overlaps with TWT SP with other value in TWT Flow identifier value. | As in comment. | Reject – even though two SPs might overlap, the scheduling STA can meet both conditions, as each trigger transmitted belongs to one or the other TWT then each trigger therefore obeys the rules and parameters associated with its respective TWT. |
| **12039** | Jarkko Kneckt | 9.4.2.200 | 127.14 | The "Request TWT" TWT Setup Command Value says that requesting STA does not specify target wake time. To which value the Target Wake Time value is set? Are all other values of TWT parameter set to requested values? | Please clarify to which value the STA sets the Target Wake Time value when Request TWT TWT Command value is used. One possibility would be to set the Target Wake Time to 0 to indicate that STA does not have any preference. | Reject – the setting of Target Wake Time is already specified as 0 when the command is Request within the baseline. |
| **12040** | Jarkko Kneckt | 9.4.2.200 | 124.29 | Currently, the AP does not get information of the times that are not suitable for the TWT requesting STA to have a TWT SP. The AP needs the information of the unsuitable times to select the best times for the TWT SPs, if the AP needs to alternate or dictate the TWT SP times. Without knowledge of the unsuitable times, the TWT setup signaling may require unnecessary many signaling messages transmissions or the TWT SPs may occur during the times when STA needs to suspend the frames delivery or use lower transmission rate that degrades the link performacne and BSS throughput. | Allow the non-AP STA to signal by using TWT Setup signaling the times that are not suitable for it to have TWT SPs. This information is only available at non-AP STA and it enables AP to select more wisely the TWT SP times and ensures good performance for the BSS. | Reject – a proposal for such functionality was presented and a straw poll showed insufficient support to add the functionality to the draft. |
| **12084** | Jinsoo Ahn | 9.4.2.200 | 131.33 | What is the 'special broadcast TWT'? | Define the term or change to TWT with OPS | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12084, which simply delete the word “special” |
| **12230** | kaiying Lv | 9.4.2.200 | 125.21 | The setting of "The Last Broadcast Parameter Set subfield" is decribed in page 129. Delete the sentence here "The Last Broadcast Parameter Set subfield is set to 1 in the last broadcast TWT parameter set of the element and is set to 0 in all other broadcast TWT parameter sets. " | as comment | Accept |
| **12313** | Laurent Cariou | 9.4.2.200 | 129.38 | In the TWT flow identifier table for BCST TWT, for value 1 and 2, feedbacks can also be contained in an NDP feedback report | Add NDP feedback report in the containers for feedbacks, and reference the NDP feedback report procedure | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12313 |
| **12387** | Liwen Chu | 9.4.2.200 | 125.34 | The description in column TWT Wake Time field is not accurate. It should be the start time of .... | Change the text per the comment. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12387, which are in general agreement with the comment |
| **12394** | Liwen Chu | 9.4.2.200 | 125.44 | Add "or Individual TWT announcement by TWT responder" under Description column | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12394, which are in general agreement with the comment |
| **12395** | Liwen Chu | 9.4.2.200 | 126.30 | The TWT Request is not needed since the TWT Command clearly tell whether the command is from requester/scheduled STA or rresponder/scheduling STA. | Make TWT Request reserved. | Reject – the bit exists in the baseline with this interpretation, so if such a change were to be adopted, it would first have to be debated and approved within TGmd. |
| **12396** | Liwen Chu | 9.4.2.200 | 127.21 | In description column, make it clear when the TWT parameters other than TWT Wake Time are not satisfied, whether Accept can be responded. | As in comment | Reject – the baseline language uses the phrase “that differs from”. By definition, if any of the parameters has a different value, then the TWT itself would be different and therefore satisfy the condition. |
| **12397** | Liwen Chu | 9.4.2.200 | 127.34 | TBTT negotiation is missing from description column | Change the text per the comment. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12397 |
| **12398** | Liwen Chu | 9.4.2.200 | 127.54 | TBTT negotiation is missing from description column | Change the text per the comment. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12398 |
| **12399** | Liwen Chu | 9.4.2.200 | 128.47 | The following are not defined:TWT Wake Interval, TWT. | Coorect them. | Reject – TWT is Target Wake Time and is defined in clause 3. TWT Wake Interval is defined in 9.4.2.200 TWT element |
| **12400** | Liwen Chu | 9.4.2.200 | 128.38 | You think Dictate TWT is N/A? | Add the description of it | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12400 |
| **12401** | Liwen Chu | 9.4.2.200 | 128.43 | You think Reject TWT is N/A? | Add the description of it | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12401 |
| **12402** | Liwen Chu | 9.4.2.200 | 128.33 | Why is a scheduling AP not albe to provide alternate broadcast TWT parameters to a scheduled STA? | Add such usage in Description column | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12402 |
| **12403** | Liwen Chu | 9.4.2.200 | 128.55 | Change "Trigger frame" in the paragraph to "Trigger or UMRS" | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12403 |
| **12404** | Liwen Chu | 9.4.2.200 | 129.20 | You didn't read 27.7.3.4 or the author who wrote 27.7.3.4 didn't read this sentence. | Remove the sentence or add in 27.7.3.4 about how to use TWT Flow Identifier | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12404, which removes the sentence. |
| **12405** | Liwen Chu | 9.4.2.200 | 129.27 | The filed name is misleading | Change the filed name when Broadcast subfleid is 1 so that the field name correctly reflect the definition of the field in broadcast TWT. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12405 |
| **12406** | Liwen Chu | 9.4.2.200 | 129.45 | Can you find HE variant HT Control in 27.5.1? | Remove 27.5.1 (HE DL MU operation) since the related description is in 27.5.3. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12406, which removes the reference. |
| **12407** | Liwen Chu | 9.4.2.200 | 129.45 | BQR is missing | Add the subclause related BQR | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12407. |
| **12408** | Liwen Chu | 9.4.2.200 | 130.14 | Combining sounding feedback with random RU makes the sounding protocol complicated | Remove the bullet related to sounding feedback. | Reject – the AP is generally in charge of what responses will be elicited, so there is no need to make any rules. If you don’t like the complication, then don’t do that. |
| **12409** | Liwen Chu | 9.4.2.200 | 129.41 | Change HT TB NDP PPDUs to HE TB NDP PPDUs | As in comment | Accept |
| **12410** | Liwen Chu | 9.4.2.200 | 130.44 | You can't indicate broadcast TWT in this case. | Removing "that indicates a broadcast TWT" from the sentence. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12410. |
| **12411** | Liwen Chu | 9.4.2.200 | 130.52 | change to "When transmitted by a TWT requesting STA or a TWT scheduled STA, the Target Wake Time field which is not in TWT element with TWT Setup Command subfield equal to "Request TWT" contains a positive 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"." | As in comment | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12411. |
| **12412** | Liwen Chu | 9.4.2.200 | 130.58 | A TWT scheduling AP will not transmit TWT element to TWT requesting STA. | Change the text to fix the issue in the comment. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12412. |
| **12413** | Liwen Chu | 9.4.2.200 | 130.61 | The TWT responding STA will not request TWT rscheduled STA to wake up. | Change the text to fix the issue in the comment. | Revise - TGax editor to make changes as shown in 11-17/1893r6 that are marked with CID 12413. |
| **13000** | Massinissa Lalam | 9.4.2.200 | 129.00 | In Table 9-262k1, remove one extra full stop in row 1 and row 2 (end of column 2) ("transmitted by the TWT Scheduling AP.."). | As in comment | Accept |

**Discussion:**

Extemporized.

**Proposed Changes to Draft Text of TGax D2.0:**

***TGax editor: within subclause 9.4.2.200 TWT element, modify the text and figures as shown and instructed:***

**9.4.2.200 TWT element**

***Change the first paragraph as follows:***

The TWT element format when the Broadcast subfield of the Control field is 0 is shown in Figure 9-589av.

***Replace the title of Figure 9-589av with “TWT element format when the Broadcast subfield is 0” Insert a new paragraph and associated figure after the first paragraph as follows:***

The TWT element format when the Broadcast subfield of the Control field is 1 is shown in Figure 9-589av1 (TWT element format when the Broadcast subfield is 1).

***TGax editor: modify Figure 9-671 – TWT element format, consolidating all fields after the control field into a single field called “TWT Parameter Information” with an octet count of variable, the resulting figure without change marks would appear as shown:* (#11123)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | Element ID | Length | Control | TWT Parameter Information |
| Octets: | 1 | 1 | 1 | variable |
| Figure 9-671 - TWT element format | | | | | |

***TGax editor: add a new paragraph to appear immediately after Figure 9-671 – TWT element format as follows:* (#11123)**

The TWT Parameter Information field is variable in length and contains a single Individual TWT Parameter Set field when the Broadcast subfield of the Control field has the value 0 and contains one or more Broadcast TWT Parameter Set fields when the Broadcast subfield of the Control field has the value 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. **(#11123)**

***TGax editor: add a new figure, Figure 9-589av666 – Individual TWT Parameter Set field format as shown, immediately after the paragraph that is inserted after Figure 9-671 – TWT element format:* (#11123)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | |  | | | | |  |
|  | Request Type | | Target Wake Time | | TWT Group Assignment | Nominal Minimum TWT Wake Duration | TWT Wake Interval Mantissa | TWT Channel | NDP Paging (optional) |
| Octets: | 2 | | 8 or 0 | | 9 or 3 or 0 | 1 | 2 | 1 | 0 or 4 |
|  | | **Figure 9-589av666 – Individual TWT Parameter Set field format** | | | | | | | | |

***TGax editor: replace Figure 9-589av1 – TWT element format when the Broadcast subfield is 1 with the following Figure and caption:* (#11123)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | | | | |
|  | Request Type | Target Wake Time | Nominal Minimum TWT Wake Duration | TWT Wake Interval Mantissa | Broadcast TWT Info |
| Octets: | 2 | 2 | 1 | 2 | 2 |

**Figrue 9-589av1 - Broadcast TWT Parameter Set format**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 B3**(#11007)** |  | ~~B3~~B4 B7 **(#12033)** |
|  | NDP Paging Indicator | Responder PM Mode | Negotiation Type |  | Reserved |
| Bits: | 1 | 1 | 2 |  | ~~6~~4 |
| * Control field format | | | | | |

***TGax editor: throughout Draft 2.0, replace “Broadcast field is set to 1” with “Negotiation Type field has the value 10 or 11”* (#11007)**

***TGax editor: throughout Draft 2.0, replace “Wake TBTT Negotiation is set to 1” with “Negotiation Type field has the value 01”* (#11123) (#11007)**

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

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

When B2 of the Negotiation Type subfield is 1 then one or more broadcast TWT parameter sets are contained in the TWT element where each TWT parameter set contains the Request Type, Target Wake Time, Nominal Minimum TWT Wake Duration, TWT Wake Interval Mantissa and Broadcast TWT Info subfields. **(#12230)** When B2 of the Negotiation Type subfield is equal to 0, only one Individual TWT parameter set is contained in the TWT element. An S1G STA sets the Negotiation Type subfield field to 00. **(#11007)**

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 Figure 9-262j1 - Interpretation of Negotiation Type subfield, Target Wake Time, TWT Wake Interval Mantissa and TWT Wa.

|  |  |  |  |
| --- | --- | --- | --- |
| * Interpretation of Negotiation Type subfield, Target Wake Time, TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields (#11007) | | | |
| Negotiation Type subfield value  B2 B3(#11007) | Target Wake Time field | TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields | Description |
| 00**(#11007)** | A future Individual TWT SP start time | Interval between individual TWT SPs | Individual TWT negotiation between TWT requesting STA and TWT responding STA. See 10.43 (Target wake time(TWT)), and 27.7.2 (Individual TWT agreements) or Individual TWT announcement by TWT responder. **(#12394)** |
| 01**(#11007)** | Next Wake TBTT time | Interval between wake TBTTs | Wake TBTT and wake interval negotiation between TWT scheduled STA and TWT scheduling AP. See 27.7.3.4 (Negotiation of wake TBTT and wake interval). |
| 10**(#11007)** | 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). |
| 11**(#11007)** | A future Broadcast TWT SP start time **(#12387)** | 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). |

(#8125, #8130, #3031, #4766, #7170, #7358, #7924, #8123, #9843, #9971)

Change Figure 9-589ax (Request Type field format) as follows (B4 from "Reserved" to "Trigger").

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 B3 | B4 | B5 | B6 | B7 B9 | B10 B14 | B15 |
|  | TWT  Request | TWT Setup Command | ~~Reserved~~  Trigger | Implicit / Last Broadcast Parameter Set(#3123) | Flow  Type | TWT Flow  Identifier/Broadcast TWT Recommendation **(#12405)** | 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: (#12397) (#12398)

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. The use of the TWT Setup Command field for negotiation of individual and broadcast TWT is described shown in Table 9-289 (TWT Setup Command field values(11ah)). The entries in the table apply to cases when the Negotiation Type field has the value b10 or b11, or the Negotiation Type field has the value b00. For TWT Setup Command field use when the Negotiation Type field has the value b01, see 27.7.3.4 (Negotiation of Wake TBTT and wake interval). **(#12397) (#12398)**

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, 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(#7928)) 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 STA 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 | 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 | 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(#Ed) the TWT SP indicated by the TWT element includes Trigger frames or UMRS Control field **(#12403)** as defined in 27.7 (TWT operation). 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. **(#11987)**

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.(#3123, #5034)

Change the 11th paragraph as follows:

The TWT Flow Identifier/Broadcast TWT Recommendation **(#12405)**subfield 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 **(#12405)**subfield contains a value that indicates recommendations on the types of frames that are transmitted by TWT scheduled STAs and scheduling AP(#7923) during the broadcast TWT SP, encoded according to Broadcast TWT Recommendation field for a broadcast TWT element. The TWT Flow Identifier/Broadcast TWT Recommendation**(#12405)** is reserved when transmitted by a TWT scheduled STA**(#11369)(#12404)** (#5673, #5759)

Insert a new table as follows:

|  |  |
| --- | --- |
| * Broadcast TWT Recommendation (#12405)field 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(#7359) 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 field), etc.)(#7930) * Feedback in an HE TB NDP PPDU, if the AP solicits it (see 27.6.5 (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(#7598)   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.(#7929) **(#11700)(#13000)** |
| 2 | Frames transmitted during a broadcast TWT SP by a TWT scheduled STA(#9844) are recommended to be limited to solicited status and feedback:   * PS-Poll and QoS Null frames * Feedback can be contained in(#6353) 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 field), etc.)(#7930) * 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(#7931) Request frames * Control response frames(#7599)   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.(#7929). |
| 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(#7932) 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(#7551) expects to elapse between successive TWT SP start times (see Table 9-262j1 (Interpretation of Target Wake Time, TWT Wake Interval Mantissa and TWT Wake Interval Exponent fields)). 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 SP start times. **(#12035)** In a TWT element contained in a TWT request that is sent by the scheduled STA to negotiate it’s wake intervals, the TWT wake interval indicates the value of the wake interval (see 27.7.3.4 (Negotiation of wake TBTT and wake interval)(#8510))(#8154). **(#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 unsigned integer ~~which~~ that (#6356)corresponds to a TSF time at which the STA requests to wake. 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. **(#12411)**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 4 of the relevant TSF value. When a TWT responding STA(#6919) with dot11TWTGroupingSupport equal to 0 transmits a TWT element to a TWT requesting STA, the TWT element contains a value in the Target Wake Time field ~~which~~ that (#6357)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 contains the Broadcast TWT ID subfield, the Broadcast TWT Persistence Exponent subfield and the Broadcast TWT Persistence Mantissa subfield as shown 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 **(#11005)** |
| * Broadcast TWT Info subfield format | | |  |

The Broadcast TWT Persistence Mantissa subfield and Broadcast TWT Persistence Exponent subfield together indicate the numberof beacon intervals 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 2^(Broadcast TWT Persistence Exponent), except that the value of 255 in the Broadcast TWT Persistence Mantissa subfield indicates that the Broadcast TWT SPs are present indefinitely, 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~~,~~(#6359) is not present. The value 0 in the Broadcast TWT ID subfield indicates the broadcast TWT whose membership corresponds to all STAs that are members of the BSS corresponding to the BSSID of the management frame carrying the TWT element. **(#12084)**

Change the 22nd and subsequent two paragraphs as follows:

When transmitted by a TWT requesting STA that is not an S1G STA, the TWT Channel field is reserved.(#5768, #6089) When transmitted by a TWT requesting STA that is an S1G STA(#5768, #6089), 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 an S1G STA(#5768, #6089), 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. 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. 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. The TWT Channel field is not present when the Broadcast field(#7184) 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(#6361) that are set up within an S1G BSS
* Enabling NAV protection during the TWT SP(s) for the TWTs(#6361) that are set up within an HE BSS

A TWT requesting STA sets the TWT Protection subfield to 0 if TWT protection (#5769)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(#6919), 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(#6919) 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(#5327) the responding STA or scheduling STA is an S1G STA.
* Enabling NAV protection during the TWT SP(s) for the TWTs where(#5327) the responding STA or scheduling AP is an HE STA.(#6363)

A TWT responding STA or TWT scheduling AP(#6919) sets the TWT Protection subfield to 0 to indicate that the TWT SP(s) identified in the TWT element might not be protected.

***TGax editor: within subclause 27.7.3.3 Rules for TWT scheduled STA append a sentence to the indicated paragraph, as shown:***

**27.7.3.3 Rules for TWT scheduled STA**

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 establishing a membership for the broadcast TWT with those broadcast TWT IDs, or by negotiating a wake TBTT and wake interval between Beacon frames that the STA receives, as defined in 27.7.3.4 (Negotiation of wake TBTT and wake interval), or has sent a PS-Poll or UPSD trigger frame or any other indication that it is in the awake state during that beacon interval . A TWT scheduled STA is not required to be in the awake state at broadcast TWT start times corresponding to the broadcast TWT that has the broadcast TWT ID value of 0. **(#11863)**

**End of proposed changes.**