IEEE P802.11  
Wireless LANs

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| LB203 Proposed Resolutions for Subclause 9.42a Target wake time (TWT) | | | | |
| Date: 2014-09-02 | | | | |
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Abstract

Addressing some CIDs from LB203 which relate to Subclause 9.42a Target wake time (TWT) which is the beahvior subclause for TWT, including resolutions for

CIDs: 3037, 3038, 3349, 3350, 3351, 3353, 3354, 3355, 3356, 3537, 3540, 3541, 3542, 3543, 3544, 3545, 3623, 3788, 3789, 3790, 3791, 3792, 3793, 3794, 3795, 3796, 3797, 3798, 3799, 3726, 3727, 3492

* (33 CIDs)

**REVISION NOTES:**

R0: initial

R1: changes from review during 2014/09/16 session EVE

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 TGah Draft. This introduction is not part of the adopted material.

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

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

**CID LIST:**

| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
| 3037 | Adrian Stephens | 272.46 | 9.42.1 | "STAs that request and set up a TWT agreement are called TWT STAs and the STAs with which they havesuch an agreement are TWT peer STAs."  This is too subtle, and will cause confusion. Be more explicit about the roles | Rename "TWT STA" to "TWT initiator" and "TWT peer STA" to "TWT responder" throughout the draft. I'm not wedded to these terms, you can probably come up with a better one. But the point I'm trying to avoid is the need to interpre the absence of the word "peer" as defining your role. | Revise - generally agree with commenter - note that two such terms already exist in the TWT information element subclause and those terms are adopted in the behavior subclause for the proposed resolution - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3037 |
| 3038 | Adrian Stephens | 274.42 | 9.42.1 | "When dot11TWTOptionActivated is true, an S1G AP may use the Wake Interval in determining the lifetime of frames that it buffers for an S1G TWT STA"  This is both incomplete "may use" and unncessary. It is incomplete because it gives a hint, but is not explicit. It is unnecessary because an AP can drop frames willy-nilly according to its own criteria. | Turn into a NOTE and replace "may" with "might". | Accept |
| 3349 | Alfred Asterjadhi | 273.40 | 9.42.1 | clarify when is "Adjusted Minimum TWT Wake Duration" calculated? | clarify in text. | Revise - generally agree with commenter - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3349 |
| 3350 | Alfred Asterjadhi | 274.07 | 9.42.1 | "shall not queue"-->shall not respond" and move the entire paragraph to the end of 9.42.5 | clarify in text. | Revise - sort of agree with the first part of the comment but not with the second part because the TWT group concept is not tied to the use of group address values in the receive address field - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3350 |
| 3351 | Alfred Asterjadhi | 275.14 | 9.42.2 | While it is clear that the TWT peer STA shall transmit TACK/STACK etc it is not clear why the TWT STA shall send these frames as well. | Please clarify. | Revise - inserted some justification - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3351 |
| 3353 | Alfred Asterjadhi | 276.01 | 9.42.3 | what does "Next TWT Request subfield equal to 0 or 1" mean? If the Next TWT Request subfield does not matter, then don't mention it at all. | As in comment | Revise - removed the offending text as proposed resolution - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3353 |
| 3354 | Alfred Asterjadhi | 276.16 | 9.42.3 | "TWT peer STA" --> "TWT STA" | As in comment | Revise - agree with the commenter as to the identity of the participant, but the terms are changing - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3354 |
| 3355 | Alfred Asterjadhi | 276.22 | 9.42.3 | what does"shall queue" mean? It is redundent with the sentence on line 33. please remove this sentence. | As in comment | Revise - the commenter is incorrect in that the text cited on line 33 is prefaced by a condition that is not part of the text on line 22 - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3355 |
| 3356 | Alfred Asterjadhi | 276.29 | 9.42.3 | "contains a Next TWT value" --> "contains a non-zero Next TWT value" | As in comment | Revise - generally agree, changed in several places and noting that there really was no indication of the differerence between zero and non-zero values of this field - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3356 |
| 3537 | Graham Smith | 272.63 | 9.42.1 | I think that TWT is a good feature and I would like that it could be used by other sensor type devices. Except that support of TWT is only advertised in the S1G capabilites element I think Implicit TWT it could be used generally as is. Suggest that a line be added to Table 8.142 extended Capabilities element. | Add after line 64 "A STA with dot11TWTOptionActivated equal to true, that is not an S1G STA, shall set the TWT Support subfield to 1 in all Extended Capabilities elements (8.4.2.26) that it transmits. A STA with dot11TWTOptionActivated equal to true, that is not an S1G STA, shall only use Implicit TWT. In addition add new row to Table 8.142 "9: TWT supported: The STA sets TWT supported to 1 when dot11TWTOptionActivated is equal to true" In Addition add at start of 9.42.3 " A STA with dot11TWTOptionActivated equal to true, that is not an S1G STA, cannot use Explicit TWT operation." | Reject - there is a legacy STA interaction issue that arises with the introduction of these features outside of S1G operation which require a great deal more changes to the specification in order ot allow the mechanisms to operate - such interaction is beyond the scope of work of the task group and is better suited to later efforts on the part of TGm. |
| 3540 | Graham Smith | 272.50 | 9.42.1 | "During a TWT, the TWT peer STA can send information about the next TWT to each participating TWT STA." Only really true for explicit TWT. Implicit TWT does not send the next TWT information in the TWT. | Delete cited sentence. | Accept |
| 3541 | Graham Smith | 272.54 | 9.42.1 | "The maximum number of outstanding TWT values..." Not sure about the adjective 'outstanding'. Surely the max number is 8 and that is all. Also 'outstanding' can mean 'really good'. | delete "outstanding" | Revise - generally agree, group proposes a bit more changes to make it even more clear - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3541 |
| 3542 | Graham Smith | 273.01 | 9.42.1 | "A non-AP STA with dot11TWTOptionActivated equal to true may transmit a TWT element to its associated AP with a value of Request TWT, Suggest TWT or Demand TWT in the TWT Command field and a value of 1 in the TWT Request field if the most recently received S1G Capabilities element received from the AP included a value of 1 in the TWT Support subfield." Would read better if the support field criteria comes first. | Rewrite to read "If the most recently received S1G Capabilities element received from the AP included a value of 1 in the TWT Support subfield, a non-AP STA with dot11TWTOptionActivated equal to true may transmit a TWT element to its associated AP with a value of Request TWT, Suggest TWT or Demand TWT in the TWT Command field and a value of 1 in the TWT Request field." | Revise - generally agree, slight rewording of commenter’s proposed resolution needed regarding association - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3542 |
| 3543 | Graham Smith | 273.07 | 9.42.1 | "An AP with dot11TWTOptionActivated equal to true..." Surely if the AP had received a TWT frame from a STA, then it this must be true? A STA would not send the TWT request if the AP doid not support TWT. | Cited sentence to read "A TWT AP shall transmit a TWT element to a STA with which it is associated and from which it received a frame containing a TWT element..." | Reject - even though it might sound redundant, it is important to clearly qualify the AP that is performing some behavior. |
| 3544 | Graham Smith | 273.23 | 9.42.1 | "...and no other condition requires the STA to remain awake." Huh, this seems superfluous. You have used the verb "may" and then set that it must indicate that it in the power save condition, so this addition is confusing. | Delete cited phrase. | Reject - the use of may with no further condition is sufficient to allow the reader to believe that a simple choice is being presented here without additional restriction, as this is the common practice in the rest of the standard. The language that the commenter wishes to delete serves as an important reminder to the reader that other conditions do exist elsewhere. |
| 3545 | Graham Smith | 273.55 | 9.42.1 | "A non-AP STA with dot11TWTOptionActivated equal to true shall transmit..." All the actions cannot have happened if the STA was not TWT capable. | Replace with "A non-AP TWT STA shall transmit..." | Reject - even though it might sound redundant, it is important to clearly qualify the non-AP STA that is performing some particular behavior. Also the term proposed has not been defined - defining it would result in as much text as exists now because there is only one instance where it would be used. |
| 3623 | Jerome Henry | 272.43 | 9.42.1 | this mechanism efficientcy may need to be improved, for 2 reasons: 1. it reduces the deterministic aspect of wi-fi transmission:a sensor may need to report an emergency value (fire etc) and be unable to do so because the AP is sleeping. This reduces the chances of adoption for this protocol in sensor networks where emergency reports are needed. Authors may reply that in these networks the AP would not sleep, but then this mechanism should be configurable and described as optional for APs. Some configuration should be able to say "no TWT for APs" somewhere in these deployments. 2. The mechanism may force stations to be awake, just to hear that the Ap goes to sleep. This may happen for every twt cycle, and may greatly reduce the stations battery time, especially as the AP would only sleep after each non-AP STA accepted the TWT, which can result in hundreds of frame exchanges in large cells (especially with relays), just to allow the AP to sleep for a few intervals. Making the mechanism simply optional instead of making it efficient does not seem to be an efficient way of solving the issue. | Add a mechanism by which a station may request "never sleep" from the AP. In that case, the Ap would not sleep even if other stations allow it. Alternatively, allow that the admin may configure an "APs can't sleep" option even if the Ap has the ability to sleep and thus save power... or remove the option for an Ap to sleep altogether, which would be the most effiecient way of saving non AP STA battery time IMHO. | Revise - the group chooses to add an explicit indication of support for each of TWT responder STA and TWT requester STA functionality so that an AP can indicate that it does not support TWT requester STA functionality while it does support TWT responder STA functionality - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3623 |
| 3788 | Liwen Chu | 272.40 | 9.42.1 | Change the definition of TWT STA and TWT peer STA as following: 1), TWT STAs are STAs that are capable of TWT operation, 2), TWT initiator is the STA that initiates TWT operation with another TWT STA. 3), TWT responder is the TWT-capable STA that accepts the TWT operation from TWT initiator. 4), TWT initiator and TWT responder are TWT peer STAs. | As in comment. | Revise - as per other CIDs on the same topic, the group proposes to use the terms found in the TWT IE subclause which are TWT requesting STA and TWT responding STA, there is no need for the term TWT STA and there is no need for the term TWT peer STA - see CID 3037 - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3788 |
| 3789 | Liwen Chu | 272.42 | 9.42.1 | It should be "the TWT peer STA advises a schedule and delivers TWT values to the TWT STA. During a TWT," | As in comment. | Revise - generally agree but chose different words than those proposed by the commenter - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3789 |
| 3790 | Liwen Chu | 273.02 | 9.42.1 | It is not necessary to include Request, Suggest, Demand TWT. To simplify the protocol, what the TWT STA send is just requested TWT. | As in comment. | Reject - the different levels of request establish the amount of flexibility that exists in the request. As an example, it is estimated that most TWT responding STAs will have a few fixed schedules and will try to accommodate all requests to fit as closely as is possible to those schedules. STAs that are too inflexible to accept those fixed schedules need a mechanism to communicate their inflexibility to the TWT responding STA so that an agreement is not established which is unworkable for the TWT requesting STA. |
| 3791 | Liwen Chu | 273.12 | 9.42.1 | It is not necessary to include Accept, Alternate, Dictate, Reject TWT. To simplify the protocol, what the TWT peer STA send is just accept/reject TWT. When the response is reject, the TWT peer STA can send a alternate TWT. | As in comment. | Reject - the different levels of request establish the amount of flexibility that exists in the request. As an example, it is estimated that most TWT responding STAs will have a few fixed schedules and will try to accommodate all requests to fit as closely as is possible to those schedules. STAs that are too inflexible to accept those fixed schedules need a mechanism to communicate their inflexibility to the TWT responding STA so that an agreement is not established which is unworkable for the TWT requesting STA. |
| 3792 | Liwen Chu | 274.46 | 9.42.1 | TWT has TWT STA/TWT peer STA and TWT Requesting STA/TWT Responding STA. One pair of TWT STA definition should be enough. | Remove one pair of TWT STA type. | Revise - as per other CIDs on the same topic, the group proposes to use the terms found in the TWT IE subclause which are TWT requesting STA and TWT responding STA, there is no need for the term TWT STA and there is no need for the term TWT peer STA - see CID 3037 - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3792 |
| 3793 | Liwen Chu | 275.03 | 9.42.2 | In 9.42.1,a TWT peer STA should include a Pentapartial Timestamp field or a Tetrapartial Timestamp field or a Timestamp field in at least one frame transmitted to a TWT STA during a TWT SP for that STA. In 9.42.2, a TWT peer STA shall transmit a STACK frame in response to a frame received from a TWT STA which has the value NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION and that is not an A-MPDU or a VHT single MPDU.  Which one is true? | Clarify it. | Reject - both are true and there is no contradiction. The first citation is a reference to a recommended practice, and the second is a reference to a required response transmission given a specific reception. It is possible that the condition indicated in the second citation does not occur, for example, NORMAL RESPONSE is not in the the RXVECTOR of the reception, or as another example, that there is no reception from the STA. In either case, the recommendation in the first citation is still true and correct and does not contradict the second citation. Even if a frame is received during a TWT SP which requires a STACK response, this too, does not contradict the first citation, but instead, satisfies it. |
| 3794 | Liwen Chu | 275.06 | 9.42.2 | "is not an A-MPDU or a VHT single MPDU" is not clear. It should be " is not an A-MPDU and not a VHT single MPDU" or "is a MPDU in a PPDU" | As proposed in comment. | Revise - used the first suggested replacement - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3794 |
| 3795 | Liwen Chu | 275.14 | 9.42.2 | If a TWT STA is non-AP STA and TWT peer STA is AP, why does non-AP TWT STA need to transmit STACK/TACK/BAT to TWT peer AP? | Clarify it. | Revise - even before making changes to the draft, the language of D2.0 is with reference to the two distinct entities within a TWT agreement, where no restrictions exist regarding which type of STA (i.e. AP vs non-AP STA) can act in either role (i.e. TWT STA vs TWT peer STA in D2.0, now changed to TWT requesting STA and TWT responding STA) - so the question being asked by the commenter is already clearly answered by virtue of the fact that any STA, AP or non-AP STA can become the STA which must “appear” at TWT times supplied by the other STA - yes, even an AP can be directed to “appear” - note that just because there is a TWT SP and a STA needs to be present for the TWT, it is not a requirement tha the STA be in DOZE outside of the TWT SP, but also, it is not forbidden, even for an AP, to be in DOZE outside of the TWT SP - the proposed resolution is revised because the terminology has been changed as previously mentioned - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3795 |
| 3796 | Liwen Chu | 275.17 | 9.42.2 | "is not an A-MPDU or a VHT single MPDU" is not clear. It should be " is not an A-MPDU and not a VHT single MPDU" or "is a MPDU in a PPDU" | As proposed in comment. | Revise - used the first suggested replacement - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3796 |
| 3797 | Liwen Chu | 275.27 | 9.42.2 | Other subclauses should be listed clearly. | Change the text per the comment. | Revise - add reference to 9.3.2.15 response indication procedure - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3797 |
| 3798 | Liwen Chu | 276.16 | 9.42.3 | This paragraph is not easy to understand.  Why does a TWT responding STA need to solicit the response of a TWT Information frame?  Rewrite it. | As in comment. | Revise - change TWT peer STA to TWT requesting STA as per CID 3354 - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3798 |
| 3799 | Liwen Chu | 276.46 | 9.42.3 | "An AP TWT initiation frame indicates the start time for a series of TWT SPs corresponding to a single TWT Identifier if the Implicit bit of the TWT element in the frame is equal to 1."  This should be in implicit TWT subclause. | Move it to implicit TWT subclause or delete it. | Revise - moved the text and modified it in the process to make it read more accurately and provide active verb syntax and made similar modifications to the parallel language describing the explicit case - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3799 |
| 3726 | Liwen Chu | 140.51 | 8.4.2.170i | If more than one bit in the bitmap is 1, does this mean that multiple channels can be primary channels? If no, what is the allowed channel bandwidth in TWT TX. If yes, working in different primary channel may create mismatching of primary channel assumption and the TX/RX may not be able to coordinate with each other.. | Clarify it. | Revise - the text of 9.42a.1 already limits the response to a single bit in the bitmap. The allowed channelization is restricted by the BSS BW field of the S1G Beacon, but this was not stated explicitly. However text which is proposed to be added in 11-14-0959r3 for CID 3197 does make this statement, so the CID 3197 changes address this CID as well. |
| 3727 | Liwen Chu | 281.40 | 9.42.1 | Separate this subclause to two: non-AP initiating TWT setup and AP initiating TWT setup | As proposed | Reject - there are some areas of the description in this subclause that are common to both cases. |
| 3492 | David Hunter | 273.38 | 9.42.1 | The following sentence appears to be the definition of "Adjusted Minimum TWT Wake Duration": "A MAC variable Adjusted Minimum TWT Wake Duration is defined for each TWT of each TWT agreement and has a value equal to Nominal Minimum TWT Wake Duration minus the elapsed time from the start of the TWT SP, where the start of the TWT SP is determined after any necessary TSF adjustment." But this name does not name a frame, field, element, value or other formally defined exchange object, so should not use initial caps. | Replace "Adjusted Minimum TWT Wake Duration" with "adjusted minimum TWT wake duration" throughout the draft. Likewise for the undefined term "Adjusted Minimum Wake Duration". On page.lines: 273.38, 276.59 and 327.1. | Revise - the baseline contains many instances of MAC variables that have various mixes of upper and lower case characters. The style guide makes no reference to the naming of variables that are not part of the MIB. But one piece of consistency is observed in the baseline, in that all variables seem to have no spaces within them - TGah editor to execute proposed changes from 11-14-1140r1 found under all headings which include CID3492 and TGah editor to change all instances of “Adjusted Minimum TWT Wake Duration” to “AdjustedMinimumTWTWakeDuration” within the TGah draft - TGah editor to replace all occurrences of “Adjusted Minimum Awake Duration” with “AdjustedMinimumTWTWakeDuration” in the draft. |

**Discussion**

**Proposed changes**

**CID 3037, 3038, 3349, 3350, 3351, 3353, 3354, 3355, 3356, 3537, 3540, 3541, 3542, 3543, 3544, 3545, 3623, 3788, 3789, 3790, 3791, 3792, 3793, 3794, 3795, 3796, 3797, 3798, 3799, 3726**

***TGah editor: Modify subclause 9.42a Target wake time (TWT) of TGah Draft 2.1 as shown:***

* Target wake time (TWT)
* TWT overview

Target wake times (TWTs) allow STAs to manage activity in the BSS by scheduling STAs to operate at different times in order to minimize contention and to reduce the required amount of time that a STA utilizing a power management mode needs to be awake. STAs that request a TWT agreement are called TWT requesting STAs and the STAs which 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. 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 (#3789). (#3540). When explicit(#3471) 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. When implicit(#3471) TWT is used, the TWT requesting STA calculates the Next TWT by adding a fixed value to the current TWT value. STAs need not be made aware of the TWT values of other STAs. The maximum number of active TWT agreements between any pair of STAs (#3541)cannot exceed 8, since the TWT Flow ID field of the TWT element comprises 3 bits. TWT responding STAs may protect TWT times with protection mechanisms including, but not limited to NAV-setting frame exchanges. TWT responding STAs that are APs may additionally protect TWT times using RAW scheduling. TWT requesting STAs may wake at times other than TWT.

A STA with dot11TWTOptionActivated equal to true and that operates in the role of TWT requesting STA shall set the TWT requester Support subfield to 1 in all S1G Capabilities elements that it transmits. A STA with dot11TWTOptionActivated equal to true and that operates in the role of TWT responding STA shall set the TWT responder Support subfield to 1 in all S1G Capabilities elements that it transmits. (#3623)

If the S1G Capabilities element (#3623) received from its associated AP included a value of 1 in the TWT Responder subfield, a (#3542) non-AP STA with dot11TWTOptionActivated equal to true may transmit a TWT element to the AP with a value of Request TWT, Suggest TWT or Demand TWT in the TWT Command field and a value of 1 in the TWT Request field.

An AP with dot11TWTOptionActivated equal to true shall transmit a TWT element to a STA with which it is associated and from which it received a frame containing a TWT element that contained a value of Request TWT, Suggest TWT or Demand TWT in the TWT Command field and a value of 1 in the TWT Request field. The transmitted TWT element shall be included in the frame that is the appropriate response frame to the received frame. The AP shall include a value of Accept TWT, Alternate TWT, Dictate TWT or Reject TWT in the TWT Command field of the response and shall set the TWT Request field to 0. If the AP response’s TWT Command field includes anything other than Accept TWT or Reject TWT, the STA should send a new request for a TWT value by sending another frame that contains a TWT element, modifying the parameters of the request to indicate, for example,(#3546) an acceptance of a proposed alternate TWT or dictated TWT value. If the STA receives a TWT response to a TWT request with the TWT Command value of Accept TWT, then the STA has successfully completed a TWT setup with that STA for the TWT Flow Identifier indicated in the TWT response and the STA becomes a TWT requesting STA and the STA may enter the doze stateuntil the TSF matches the next TWT value of the STA, provided that the STA has indicated that it is in a power save mode and no other condition requires the STA to remain awake. The AP becomes a TWT responding STA of the TWT requesting STA. The receipt of a TWT command value of Suggest TWT implies that the STA sending the command will consider accepting a proposed TWT that differs from the value found in the TWT field of the element. The receipt of a TWT command value of Demand TWT implies that the STA sending the command will not consider accepting a proposed TWT that differs from the value found in the TWT field of the element. The receipt of a TWT command value of Alternate TWT implies that the STA sending the command will consider accepting a proposed TWT that differs from the value found in the TWT field of the element. The receipt of a TWT command value of Dictate TWT implies that the STA sending the command will not consider accepting a proposed TWT that differs from the value found in the TWT field of the element.

The MAC addresses of the TWT requesting STA and the TWT responding STA and the TWT Flow Identifier indicated in the TWT Response of a successful TWT setup between those two STAs uniquely identifies a TWT agreement. A MAC variable AdjustedMinimumTWTWakeDuration is defined for each TWT of each TWT agreement and has a value equal to Nominal Minimum TWT Wake Duration minus the elapsed time from the scheduled start of the TWT SP to the actual start of the TWT SP, where the scheduled and actual start times of the TWT SP are determined after any necessary TSF adjustment. Because the value of the AdjustedMinimumTWTWakeDuration depends on the actual TWT SP start time, it is computed for each TWT SP once the TWT SP begins. (#3349)

The TWT Wake Interval of a TWT agreement is the value calculated as shown in 8.4.2.170j (TWT element) from the TWT Wake Interval Mantissa(#Ed) and TWT Wake Interval Exponent of the TWT response that successfully completed the TWT agreement.

An AP may transmit a TWT element in an individually addressed TWT Setup frame with a value of Request TWT, Suggest TWT or Demand TWT in the TWT Command field and a value of 1 in the TWT Request field to an associated non-AP STA if the S1G (#3623) Capabilities element received from the STA included a value of 1 in the TWT Responder Support (#3623) subfield. An AP may transmit TWT Setup frames to more than one of its associated non-AP STAs.

A non-AP STA with dot11TWTOptionActivated equal to true shall transmit a frame containing a TWT element to the AP with which it is associated and from which it received an individually addressed frame containing a TWT element that contained a value of Request TWT, Suggest TWT or Demand TWT in the TWT Command field and a value of 1 in the TWT Request field. The transmitted TWT element shall be included in the frame that is the appropriate response frame to the received frame. The non-AP STA shall include a value of Accept TWT, Alternate TWT, Dictate TWT or Reject TWT in the TWT Command field of the response and shall set the TWT Request field to 0. If the non-AP STA response’s TWT Command field includes anything other than Accept TWT or Reject TWT, the AP should send a new request for a TWT value by sending another frame that contains a TWT element, modifying the parameters of the request to indicate, for example an acceptance of a proposed alternate TWT or dictated TWT value. If the AP receives a TWT response to a TWT request with the TWT Command value of Accept TWT from an associated non-AP STA, then the AP has successfully completed a TWT setup with that STA for the TWT Flow Identifier indicated in the TWT response and the AP becomes a TWT requesting STA with respect to that STA.

A non-AP STA shall not transmit (#3350) a frame containing a TWT element to the AP with which it is associated and from which it received a group addressed frame containing a value of 1 in the TWT Request field as a response to the reception of that frame.

If the NDP Paging field was not present in the TWT response corresponding to a TWT agreement, the TWT requesting STA shall be in the awake state following each TWT start time associated with each TWT agreement for at least the Adjusted Nominal Minimum Wake Duration time associated with that TWT agreement even if no PS-Poll or U-APSD trigger frame has been transmitted by the STA. If the Implicit bit is equal to 1 in the TWT response for a TWT agreement, the TWT associated with that TWT agreement is an implicit(#3471) TWT and the TWT SP associated with that TWT is an implicit(#3471) TWT SP. A TWT SP that is not an implicit(#3471) TWT is an explicit(#3471) TWT SP. If the NDP Paging field was present in the TWT response, the TWT requesting STA shall follow the operational rules defined in 9.42a.6 (NDP Paging Setup).

A TWT requesting STA that is a non-AP STA should transmit frames only within TWT SPs.

A TWT requesting STA that transmits a frame during a TWT SP is not granted any special medium access privileges, nor is there any guarantee that the TWT responding STA assigned the TWT SP to only one TWT requesting STA.

A single pair of STAs can create multiple TWT agreements. Each unique TWT agreement is identified by a Flow Identifier and the MAC addresses of the TWT requesting STA and TWT responding STA. Because the TWT Flow ID field is 3 bits in length, the maximum number of TWTs per STA pair is 8. There are no explicit restrictions on the class of traffic (i.e., EDCA Access Category) that can be transmitted within any specific TWT SP when multiple TWT agreements have been set up by a single TWT requesting STA.

A TWT requesting STA may wake to receive Beacons that are transmitted outside of a TWT SP.

A TWT responding STA should include a Pentapartial Timestamp field or a Tetrapartial Timestamp field or a Timestamp field in at least one frame transmitted to a TWT requesting STA during a TWT SP for that STA.

NOTE - When dot11TWTOptionActivated is true, a TWT responding STA (#3623) might (#3038) use the Wake Interval in determining the lifetime of frames that it buffers for a TWT requesting STA.

The Flow Type field in the TWT response that successfully set up a TWT agreement indicates the type of interaction between the TWT requesting STA and the TWT responding STA within each TWT SP for that TWT agreement. A value of 0 in the Flow Type field indicates an Announced TWT. The TWT responding STA of an Announced TWT agreement shall not transmit a frame to the TWT requesting STA within a TWT SP until it has successfully received a PS-Poll or APSD trigger frame (see 10.2.2.5 (Power management with APSD)) from the TWT requesting STA. A value of 1 in the Flow Type field indicates an Unannounced TWT. The TWT responding STA of an Unannounced TWT agreement may transmit a frame to the TWT requesting STA within a TWT SP before it has successfully received a frame from the TWT requesting STA.

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. During a TWT SP, access to a channel which is not the primary channel of the BSS shall be performed according to the procedure described in 9.42f (Subchannel Selective Transmission (SST)).

* TWT acknowledgement procedure

STAs need to be able to predict the duration of response transmissions for Duration field calculations and in addition, TWT requesting STAs might need TWT start times delivered in response frames. This subclause contains rules for TWT acknowledgements that allow both objectives to be satisfied at once. (#3351)

A TWT responding STA shall transmit a STACK frame in response to a frame received from a TWT requesting STA which has the value NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION and that is not an A-MPDU and not (#3794) a VHT single MPDU. A TWT responding STA shall transmit a TACK frame in response to a frame received from a TWT requesting STA which has the value NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION and that is a VHT single MPDU unless the VHT single MPDU contains a BAR frame, in which case, the response frame is a BAT frame. A TWT responding STA shall transmit a BAT frame in response to a frame received from a TWT requesting STA which has the value NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION and that is an A-MPDU.

A STA with dot11TWTOptionActivated equal to true and that operates in the role of TWT requesting STA shall set the TWT requester Support subfield to 1 in all S1G Capabilities elements that it transmits. A STA with dot11TWTOptionActivated equal to true and that operates in the role of TWT responding STA shall set the TWT responder Support subfield to 1 in all S1G Capabilities elements that it transmits. (#3351)

A TWT requesting STA whose transmitted TWT responder Support subfield in the S1G Capabilities element contains the value 1 (#3351) shall transmit a STACK frame in response to a frame received from a TWT responding STA which has the value NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION and that is not an A-MPDU and not (#3796) a VHT single MPDU. A TWT requesting STA whose transmitted TWT responder Support subfield in the S1G Capabilities element contains the value 1 (#3351) shall transmit a TACK frame in response to a frame received from a TWT responding STA which has the value NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION and that is a VHT single MPDU unless the VHT single MPDU contains a BAR frame, in which case, the response frame is a BAT frame. A TWT requesting STA whose transmitted TWT responder Support subfield in the S1G Capabilities element contains the value 1 (#3351) shall transmit a BAT frame in response to a frame received from a TWT responding STA which has the value NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION and that is an A-MPDU.

A TWT requesting STA that transmits a frame containing a pentapartial timestamp field shall set the value of the field to all zeroes. A TWT requesting STA that transmits a frame containing a tetrapartial timestamp field shall set the value of the field to all zeroes. A TWT requesting STA that transmits a frame containing a Next TWT Info field shall set the value of the field to all zeroes. A TWT requesting STA that transmits a frame containing a Change Sequence field shall set the value of the field to all zeroes. (#3351)

A TWT requesting STA whose transmitted TWT responder Support subfield in the S1G Capabilities element contains the value 0 that receives a frame that requires an immediate response shall transmit an appropriate response is determined in 9.3.2.15 (Response Indication procedure). (#3351)

If a TWT responding STA or a TWT requesting STA receives a frame within a TWT SP that has a value other than NORMAL\_RESPONSE in the RXVECTOR parameter RESPONSE\_INDICATION, the appropriate response is as determined in 9.3.2.15 (Response Indication procedure) (#3797).

* Explicit TWT operation

Each TWT SP start value for an explicit(#3471) TWT is transmitted by the TWT responding STA to the TWT requesting STA in the Next TWT Info/Suspend Duration field of a frame that can contain the field as described in this subclause. The TWT responding STA for an explicit(#3471) TWT may provide TWT SP start times that are related to one another in a periodic or aperiodic manner.

During an explicit(#3471) TWT SP, if a TWT responding STA receives a frame from a TWT requesting STA that permits a BAT, TACK or STACK to be sent in response the TWT responding STA shall respond with a frame that includes a Next TWT Info/Suspend Duration field either if it is required to do so according to 9.42a.2 (TWT acknowledgement procedure), or (#3356) if it has not already transmitted a non-zero (#3356) Next TWT Info/Suspend Duration field to the STA within this TWT SP. If the TWT responding STA has already transmitted a non-zero (#3356) Next TWT Info/Suspend Duration field to the STA within this TWT SP, and is not otherwise required to respond with a BAT, TACK or STACK, (#3356) the TWT responding STA may respond to the STA with a frame that contains a Next TWT Info/Suspend Duration field. When present in the response frame, the Next TWT Info/Suspend Duration field may (#3356) contain the value of the TSF timer corresponding to the next scheduled TWT SP for the STA that is the intended recipient of the frame or may contain the value 0 to indicate that the Next TWT is not currently available for this TWT (#3356).

A TWT requesting STA awake for an explicit(#3471) TWT SP shall not transmit a PS-Poll with the Poll Type subfield equal to any value other than 2.

A TWT requesting STA that is awake for an explicit(#3471) TWT SP shall not enter doze state until it has received a non-zero (#3356) Next TWT Info/Suspend Duration field from the TWT responding STA and has either (#3356) been in the awake state for at least Nominal Minimum TWT Wake Duration time from the TWT SP start time as identified by the TWT responding STA or has received an EOSP field with a value of 1 from the TWT responding STA. If more than one non-zero (#3356) Next TWT Info/Suspend Duration field is received from the TWT responding STA during a TWT SP, the receiving (#3356) STA shall discard all but the most recently received value. If no non-zero (#3356) Next TWT Info/Suspend Duration field is received from the TWT(#3352) responding STA during the TWT SP, then following the end of the TWT SP when not otherwise prohibited from transmitting, the TWT requesting STA may transmit a frame that is addressed to the TWT responding STA as a means to solicit a response frame that contains a Next TWT value. Examples of frames that will solicit a Next TWT Info/Suspend Duration field include:

* a TWT Information frame with (#3353) the TWT ID subfield equal to the TWT Identifier corresponding to the TWT agreement for which a Next TWT value is desired and with the Next TWT Size subfield equal to 0, soliciting a STACK response
* an A-MPDU containing a TWT Information frame with (#3353) the TWT ID subfield equal to the TWT Identifier corresponding to the TWT agreement for which a Next TWT value is desired and with the Next TWT Size subfield set to 0, soliciting a BAT response
* a VHT single MPDU containing a TWT Information frame with (#3353) the TWT ID subfield equal to the TWT Identifier corresponding to the TWT agreement for which a Next TWT value is desired and with the Next TWT Size subfield equal to 0, soliciting a TACK response

A TWT requesting STA (#3354) that transmits a PPDU containing a TWT Information frame receives a response frame that can include a Next TWT field, as indicated above, and therefore, is not required to set the value of the Next TWT Request subfield to 1 to solicit the response of a TWT Information frame that includes a Next TWT field.

During an explicit TWT SP, a TWT responding (#3355) STA that has transmitted a frame containing a Next TWT subfield with a value of 0 shall queue for transmission, at least one (#3355) frame to the same recipient containing the non-zero Next TWT corresponding to the TWT Identifier indicated in the frame with a value of 0 in the Next TWT subfield.

If a TWT requesting STA has transmitted a frame soliciting a response that contains a Next TWT value and the STA is in a Power Save mode, the STA shall remain in the awake state following the transmission until it receives a response from the TWT responding STA that contains a non-zero (#3356) Next TWT value. The TWT responding STA shall assume that the TWT requesting STA is in the doze state if the TWT requesting STA is in a Power Save mode, the TWT SP has ended and the TWT responding STA has not received a frame from the TWT requesting STA that solicits a response that contains a non-zero (#3356) Next TWT value. If a TWT responding STA receives a TWT Information frame from a TWT requesting STA with the Next TWT Request subfield equal to 1, then the TWT responding STA shall queue for transmission a TWT Information frame that contains a non-zero Next TWT value corresponding to the TWT Identifier of the received TWT Information frame and shall assume that the TWT requesting STA is in the awake state until the TWT responding STA has transmitted the frame containing the non-zero Next TWT value.

A TWT responding STA may include a non-zero Next TWT value in any TACK or STACK or BAT frame that is transmitted as a response to a TWT requesting STA.

The TWT responding STA shall include the initial TWT SP start time for an explicit TWT agreement in the Target Wake Time field of the TWT element which contains a value of Accept TWT in the TWT Setup Command field, a value of 0 in the Implicit bit and the TWT Identifier value corresponding to that TWT agreement in the TWT Identifier subfield. (#3799)

* (#3799)Implicit TWT operation

The TWT values for an implicit(#3471) TWT are periodic. A TWT requesting STA operating with an implicit(#3471) TWT agreement shall determine the next TWT SP start time by adding the value of TWT Wake Interval associated with this TWT agreement to the value of the start time of the current TWT SP.

The TWT responding STA shall include the start time for a series of TWT SPs corresponding to a single TWT Identifier of an Implicit TWT agreement in the Target Wake Time field of the TWT element which contains a value of Accept TWT in the TWT Setup Command field and the TWT Identifier value corresponding to that TWT agreement in the TWT Identifier subfield. The start time of the TWT SP series indicates the beginning time of the first TWT SP in the series. Subsequent TWT SPs start times are determined by adding the value of TWT Wake Interval to the current TWT SP start time. (#3799)

A TWT requesting STA awake for an implicit(#3471) TWT SP may transition to the doze state after AdjustedMinimumTWTWakeDuration time has elapsed from the TWT SP start time as identified by the TWT requesting STA.

A TWT responding STA that receives a frame from a TWT requesting STA with which it has established an implicit(#3471) TWT agreement may respond to the STA with a frame that contains a Next TWT Info/Suspend Duration field (e.g., BAT, TACK, STACK). A TWT requesting STA that is awake for an implicit(#3471) TWT SP and receives a frame with a Next TWT Info/Suspend Duration field from its TWT responding STA shall use the received Next TWT Info/Suspend Duration field value as the start of the next TWT, instead of the TWT value calculated by adding the value of Wake Interval associated with the TWT SP to the current TWT. Subsequent TWT start times associated with the same TWT agreement are calculated based on the next TWT that was sent by the TWT responding STA.

* TWT grouping(#3493)

An AP may include an S1G STA with dot11TWTOptionActivated equal to true as a member of a TWT group and signal TWT times to that STA using the TWT Group Assignment field of the TWT element.

An AP shall not include a non-S1G STA within a TWT group(#3493).

When dot11TWTGroupingSupport is true, the AP shall only assign a TWT group ID to a TWT requesting STA when the TWT Grouping Support subfield of the most recent S1G Capabilities element received from that STA contained a value of 1. The AP indicates the TWT value for a TWT requesting STA from which it received a frame containing an S1G Capabilities element with the TWT Grouping Support subfield equal to 1 that is the intended recipient of the frame containing the TWT element by including:

* The value of the assigned group ID in the TWT Group ID subfield,
* The lower 48 bits of a TSF value in the Zero Offset of Group subfield to indicate the TWT value corresponding to the first member of the TWT group(#3493) that is identified by the TWT group(#3493) ID,
* A TWT unit value in the TWT Unit (8.4.2.170j (TWT element)) subfield,
* A positive offset value indicated in the TWT Offset (8.4.2.170j (TWT element)) subfield. The allowed values in the TWT Unit subfield are given in Table 8-258a3 (TWT Unit subfield encoding).(#3547, 3357, Ed)

The intended recipient of the frame containing the TWT element calculates its TWT from the TWT Group Assignment field by multiplying the TWT Unit interpretation value with the value indicated in the TWT Offset subfield and adding the result to the value in the Zero Offset of Group field corresponding to the TWT Group ID subfield in the TWT Group Assignment field of the TWT element.

* NDP Paging Setup

This subclause defines a protocol for power saving at a STA by using the TWT protocol to setup scheduled wakeup intervals and by defining(#3548) efficient signaling(#Ed) for the presence of BUs and synchronization.

A(#3549, Ed) frame including a TWT element with the NDP Paging field present is referred to as NDP Paging Request or NDP Paging Response as clarified later. A STA sending an NDP Paging Request is referred to as NDP Paging requester. A STA sending an NDP Paging Response in a response to an NDP Paging Request is referred to as NDP Paging responder.

A STA requests an NDP Paging TWT by sending an NDP Paging Request. A non-S1G STA shall not transmit NDP Paging frames.

The setup procedure follows the protocol described in 9.42a.1 (TWT overview), unless otherwise described in this subclause.

A non-AP STA sending an NDP Paging Request to another STA, shall set the P-ID field of the NDP Paging Request to one of the partial AIDs assigned to the receiving STA (see 9.20a (Group ID, partial AID, Uplink Indication and COLOR in S1G PPDUs)).

An AP sending an NDP Paging Request to a non-AP STA should set the P-ID field of the NDP Paging Request to the Partial BSSID.

Upon receiving an NDP Paging Request, the recipient STA shall respond with an NDP Paging Response with the NDP Paging fields set as follows:

* The P-ID field should be set to the same value as the P-ID field in the NDP Paging Request.
* The Max NDP Paging period field shall be set to any value that is less than or equal to the Max NDP Paging period in the NDP Paging Request.
* The Action field shall be set to one of the values in Table 8-258a4 (Action field).
* The Partial TSF Offset field and Min Sleep Duration field are reserved.

The NDP Paging setup is successful if the TWT Setup Command field of the NDP Paging field in the NDP Paging Response is equal to 4 (Accept TWT), otherwise the setup is considered as failed.

A STA which has sent an NDP Paging Response frame with the TWT Setup Command field equal to 4 (Accept TWT) shall schedule an NDP Paging frame as the first frame for transmission at the TWTs indicated by the NDP Paging Response, if any of the following conditions is satisfied:

* There are BUs for the Requesting STA
* No NDP Paging frame was sent in the N consecutive preceding TWT(s), where N is equal to the value of the Max NDP Paging Period field in the NDP Paging Response.

The AP shall schedule an NDP Paging frame if there are critical updates to the S1G Beacon frame as defined in 10.44b (System information update procedure) and 10.2.2.17 (TIM Broadcast). An AP may additionally send an NDP Paging frame as the first frame for transmission at any of the TWT times indicated by the NDP Paging Response.

If any frame is sent by the AP to an NDP Paging requester during its indicated TWT duration then the first frame sent shall be an NDP Paging frame with Direction field equal to 1.

If any frame is sent by a non-AP STA to an NDP Paging requesters during its indicated TWT duration then the first frame sent shall be an NDP Paging frame with Direction field equal to 0.

The P-ID field of the NDP Paging frame shall be set to the same value as P-ID field in the NDP Paging Response if and only if there are BUs for the STA identified by the Partial AID indicated in the P-ID field of the NDP Paging Request. The value of the P-ID field shall be set to 0 to indicate the presence of group addressed BUs.

If the Direction field of the NDP Paging frame is equal to 1, the APDI field of the NDP Paging frame shall be set as follows:

* The PTSF field is set to TSF[Partial TSF Offset+4: Partial TSF Offset+11] (inclusive), where TSF is the 8 octets value of the TSF and Partial TSF Offset is the value of the Partial TSF Offset field in the NDP Paging Request.
* The Check Beacon field is initialized to 0 and incremented after each critical update to the Beacon frame; the value of the Check Beacon field shall be same as the LSB of the Check Beacon field in the most recent TIM Broadcast frame, if any was sent before the NDP Paging frame.

If the Direction field of the NDP Paging frame is equal to 0, the partial AID field of NDP Paging frame indicates the Partial AID of the STA transmitting the NDP Paging frame.

If no NDP Paging frame is received during the TWT, the TWT requester STA may transition to Doze state at the end of the Minimum Awake Duration for the TWT. If an NDP Paging frame is received, the TWT requester STA may transition to Doze state immediately after receiving the NDP Paging frame, unless Min Sleep Duration was equal to 0 and Action subfield(#3658) equal to 1 in the NDP Paging Response frame that successfully completed the NDP Paging setup, in which case the STA shall be in active(#3442) mode.

Upon reception of an NDP Paging frame with the P-ID field matching the value of the P-ID field in the NDP Paging Response, the NDP Paging requester STA shall behave as follows:

* If the Action subfield of the NDP Paging Response is 0:
* If the NDP Paging requester STA is a non-AP STA, it shall send a (NDP) PS-Poll or uplink trigger frame addressed to the NDP Paging responder.
* If the NDP Paging requester STA is an AP, it shall send an NDP CTS to self with the duration field equal to zero.
* If the Action subfield of the NDP Paging Response is 1, the STA shall be in the Awake state starting at a time indicated by the Min Sleep Duration field after the end of reception of the NDP Paging frame, and it shall remain in the Awake state until a frame is received from the NDP Paging responder with the EOSP subfield equal to 1.
* If the Action subfield of the NDP Paging Response is 2, the STA shall be in the Awake state at the first TBTT that occurs after a time indicated by the Min Sleep Duration field in the NDP Paging Response after the end of reception of the NDP Paging frame to receive the S1G Beacon.
* If the Action subfield of the NDP Paging Response is 3, the STA shall be in the Awake state at the first DTIM that happens after a time indicated by the Min Sleep Duration field in the NDP Paging Response after the end of reception of the NDP Paging frame to receive the DTIM Beacon.
* If the Action subfield of the NDP Paging Response is 4, the STA shall be in the Awake state starting at a time T after the end of reception of the NDP Paging frame and it shall remain in the Awake state until a frame is received from the NDP Paging responder with the EOSP subfield equal to 1. The value of T is equal to the value of the Min Sleep Duration field of the NDP Paging Request plus the value indicated by the 8 MSB of APDI field of the NDP Paging frame.

If the NDP Paging requester is an AP, values 2-7 (inclusive) of the Action subfield are reserved.

A non-AP STA which has setup NDP Paging shall wake at the next TSBTT to attempt to receive the next expected Beacon or S1G Beacon frame if it receives an NDP Paging frame with Direction field equal to 1 and the Check Beacon field value different from the most recently received value.

* TWT Sleep Setup

A Responder PM Mode bit in the Control field of the TWT response equal to 1 indicates that the Responder STA may be in Doze state outside the indicated TWT SP.

* TWT Teardown

Either STA that is a party to an established TWT agreement may delete the TWT agreement by successfully transmitting a TWT Teardown frame. The TWT Flow Identifier field of the TWT Teardown frame shall be set to the value of the TWT Flow Identifier field of the TWT element of the frame that successfully concluded the setup of the TWT agreement that is the subject of the teardown request.

When a TWT Teardown frame is successfully transmitted or received, the TWT agreement corresponding to the TWT Flow Identifier field, TWT requesting STA MAC address and TWT responding STA MAC address of the TWT Teardown frame shall be deleted.

***TGah editor: Add a reference to 9.42a Target wake time (TWT) to the BAT frame response references in the Normal Response row of Table9-4 Setting the TXVECTOR’s parameter RESPONSE\_INDICATION of 9.3.2.15 Response indication procedure of TGah Draft 2.1.***

8.4.2.170k.2 S1G Capabilities info field (#3623)

***TGah editor: Modify figure 8-575a25 - S1G Capabilities Info field by either moving the TWT Support field to a location where it can occupy two adjacent bits, or move a bit that is currently adjacent to the TWT Support field to a different location to allow the TWT Support field to be expanded to two bits, in either case, renaming the TWT Support field to “TWT Requester Support” field and adding a new, adjacent bit called “TWT Responder Support” and modify Table 8-258a5 - Subfields of the S1G Capabilities Info field by removing the row for TWT Support and adding the following two rows:***

|  |  |  |
| --- | --- | --- |
| TWT Requester Support | This bit indicates support for the role of TWT requesting STA described in 9.42a (Target Wake Time (TWT)) | Set to 1 when dot11TargetWakeTimeSupport is true and the STA supports TWT requester STA functionality (See 9.42a (Target Wake Time (TWT)))  Set to 0 otherwise. |
| TWT Responder Support | This bit indicates support for the role of TWT responding STA described in 9.42a (Target Wake Time (TWT)) | Set to 1 when dot11TargetWakeTimeSupport is true and the STA supports TWT responding STA functionality (See 9.42a (Target Wake Time (TWT)))  Set to 0 otherwise. |

**References:**