IEEE P802.11
Wireless LANs

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| CC9 Resolutions for 9-32f |
| Date: 2013-04-29 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Matthew Fischer | Broadcom | 190 Mathilda Place, Sunnyvale, CA 94086 | +1 408 543 3370 | mfischer@broadcom.com |
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Abstract

Addressing CIDs related to 9.32f Target Wake Time of TGah Call for Comments 9.

**Revision Notes**

**R1:**

CID 558 In the TWT Teardown action frame, changed the Dialog Token to a TWT Flow Field including TWT Flow Identifier subfield. Changed the description of TWT Teardown operation to reflect the change in the frame format.

CID 343 Slight changes to the TACK frame description (no change to the format).

**R0:**

Initial

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| **CID** | **Commenter Name** | **P.L** | **SC** | **Comment** | **Proposed Change** | **Resolution** |
| 647 | Ronald Murias | 88.27 | 8.4.2.170j | The description of the TWT Flow Identifier field in the paragraph in line 27 page 88 is totally unclear. What's the specific information for this TWT request? What does it mean by "other requests"?Seems like the current 11ah TWT scheme allows per traffic flow TWT, and also allows co-existence of multiple interleaving TWTs between the same pair of stations. However, the current text needs lots of clarificaitons to make such features properly described. | revise the paragraph in line 27 page 88 to properly describe the per traffic flow TWT and co-existence of multiple TWTs. | Revise – the correct location for such a description is 9.32.f – the frame format clause should contain only a description of the format, meaning a list of the fields and a short description of the fields and their units. Text to describe the use of the fields and limitations on behavior is properly located within clause 9. Some text has been added there and some already exists. In response to the question of “which information”, the information associated with the TWT is everything in the TWT IE. Other requests are identifiable by unique TWT Flow ID values which is exactly what it says in 9.32.f. TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 647 |
| 313 | Liwen Chu | 139.15 | 9.32f.1 | Given that TWT is method to decrease collision as RAW. Why don't 11ah allcote high priority to the specific TWT STA instead of normal medium access rules? |  | Reject – There already exists more than one prioritization facility within 802.11. Since there are no explicit rules about the location of TWT, there is no guarantee that the AP is scheduling STAs for single occupancy of the medium at a given TWT and using the existing prioritization mechanisms as a layer on top of the TWT allows the AP to best utilize the TWT mechanism. If the AP really wants to prioritize activity within the TWT to a higher level, it can already do so with the existing per-STA EDCA parameter assignment facility. |
| 316 | Liwen Chu | 138.60 | 9.32f.1 | In L36 sentense, A non-AP STA may transmit a TWT element to its associated AP with a value of Request TWT. Here a non-AP STA shall set the TWT Request field to 0. Which one is correct? | Clarify it. | Reject – No change needed. The sentence is somewhat complex, but parseable. In line 36, the AP shall transmit a frame with a TWT element in response to a non-AP STA transmission to the AP. The non-AP transmission had to include the value of 1 in the request field as a condition of the AP sending the response. This is not a requirement of the non-AP STA to set the request field to 1. In the subsequent sentence, the request field shall be set to one, but please re-read to note that the subject of the sentence is the AP, not the non-AP STA. This sentence is describing the contents of the frame that the AP must send in response to the reception from the non-AP STA. |
| 315 | Liwen Chu | 138.57 | 9.32f.1 | Why does a TWT non-AP STA SHALL transmit a TWT element to the AP? A TWT STA shall have the capability to transmit a TWT element but it may select not to tranmit. So SHALL should be changed to MAY. | Clarify it. | Reject – no change needed – the sentence continues after the “shall transmit” with a condition that must be satisfied – “and from which it received a TWT element . . . with a value of 1 in the TWT Request field” – in other words, if the AP sends a TWT IE with Request=1 to the non-AP STA with dot11TWTOptionActive set to true, then the non-AP STA SHALL respond. |
| 441 | Minyoung Park | 138.36 | 9.32f.1 | The following sentence: "A non-AP STA 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." does not specify in which frame the TWT element is transmitted by the AP. | Change the sentence to "A non-AP STA may transmit a TWT element in a TWT Setup frame 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." | Reject – no change needed. The text does not specify which frame is used, because there is more than one choice. If one examines the frame formats, one can see that Association Req, Assoc Resp, Reassoc Req, Reassoc Resp, TST Setup Frame all can contain the TWT IE. There is less likelihood of error if the wording in this subclause remains generic instead of adding the list of frames, which would also make the wording here rather clumsy. If the format of any frame changes to add or delete the IE, then the list must also be updated, and the probability of getting that operation correct is not high – there is no point in creating lists of information that exists elsewhere in the document, but there is a great risk of mis-synchronization of the information in the list. |
| 442 | Minyoung Park | 138.40 | 9.32f.1 | The following sentence: "An AP with dot11TWTOptionActive set to true shall transmit a TWT element to a STA ..." does not specify in which frame the TWT element is transmitted. | Change the sentence to "An AP with dot11TWTOptionActive set to true shall transmit a TWT element in a TWT Setup frame to a STA ..." | Revise – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 442  |

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| **CID** | **Commenter Name** | **P.L** | **SC** | **Comment** | **Proposed Change** | **Resolution** |
| 440 | Minyoung Park | 138.64 | 9.32f.1 | The following paragraph: "If the AP receives a TWT response to a TWT request with the TWT Command value of Accept TWT, then the AP STA becomes a TWT STA and the STA may sleep, depending on PM mode (10.2.1.19), until the TSF matches the TWT value, provided that the STA has indicated that it is in a power save mode." says that the AP may sleep until the TSF matches the TWT value once the AP receives a TWT response with the TWT Command value of Accept TWT from just a single non-AP STA. If there are more than one non-AP STA, the AP needs to send TWT requests to the rest of the non-AP STAs and receive TWT responses with the TWT Command value of Accept TWT so that all the non-AP STAs know exactly when the AP will be in awake state again. | Make the following changes to the paragraph: "If the AP receives a TWT response to a TWT request with the TWT Command value of Accept TWT from all the associated non-AP STAs, then the AP STA becomes a TWT STA and the STA may sleep, depending on PM mode (10.2.1.19), until the TSF matches the TWT value, provided that the STA has indicated that it is in a power save mode." | Accept – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 442 |

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| 443 | Minyoung Park | 138.57 | 9.32f.1 | The following sentence: "The non-AP STA with dot11TWTOptionActive set to true shall transmit a TWT element to the AP ..." does not specify in which frame the TWT element is transmitted. | Change the sentence to "The non-AP STA with dot11TWTOptionActive set to true shall transmit a TWT element in a TWT Setup frame to the AP ..." | Revise – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 443 |
| 452 | Minyoung Park | 139.06 | 9.32f.1 | The sentence "A TWT STA shall be in the awake state for at least the Nominal Minimum Wake Duration time associated with a TWT Flow Identifier following a TWT associated with that TWT Flow Identifier even if no PS-Poll or U-APSD trigger frame has been transmitted by the STA." contradicts with the rule described in P142/L25, which says "If an NDP Paging frame is received, the TWT requester STA may transition to Doze state immediately after receiving the NDP Paging frame." | Change the sentence and add a sentence at the end of the sentence as follows: "If the NDP Paging field was not present during the TWT setup, aA TWT STA shall be in the awake state for at least the Nominal Minimum Wake Duration time associated with a TWT Flow Identifier following a TWT associated with that TWT Flow Identifier even if no PS-Poll or U-APSD trigger frame has been transmitted by the STA. If the NDP Paging field was present during the TWT setup, the TWT STA shall follow the rules defined in 9.32f.5 (NDP Paging Setup)." | Accept - TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 452 |
| 314 | Liwen Chu | 138.52 | 9.32f.1 | "An AP may transmit a TWT element in a TWT Setup frame to an associated non-AP STA 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."Shouldn't it be "...non-AP STA without a value of Request..."? | Clarify it. | Revise – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 314 – the construction of the sentence leads to ambiguity about which subject is being modified by the phrase “with a value of . . .” – the solution is to move the “to a non-AP STA” prepositional clause to the end of the sentence. |

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| 874 | Yongho Seok | 138.17 | 9.32f | Because the TWT is a power saving mechanism, Section 10.2.2.20 is more appropriate. | Move Section 9.32f to Section 10.2.2.20. | Accept – Tgah editor to move the subclause as suggested. |
| 894 | Yongho Seok | 139.11 | 9.32f.1 | "A TWT SP associated with a non-implicit TWT is a non-implicit TWT SP."Change "a non-implicit TWT" to "an explicit TWT". | Change "a non-implicit TWT" to "an explicit TWT". | Revise – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 894. |

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| 564 | Mitsuru Iwaoka | 138.31 | 9.32f | It is necessary to describe how the fields of BAT frame, TACK frame, STACK frame are used. | Add the description about how to use following fields.- Partial Timestamp field- Beacon Sequence field- TA field of STACK frameDetails are TBD. | Revise – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 564. Note that descriptions of the contents of these fields will appear in the frame format subclauses of clause 8 and not here in 9.32f |
| 558 | Mitsuru Iwaoka | 138.40 | 9.32f.1 | The subclause 9.32f.1 defines the allocation of TWT, though, deletion of TWT is not described. | Add description about the de-allocation of TWT and indication of the de-allocation to the subclause 9.32f.1. | Revise – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 558. |
| 668 | Ronald Murias | 139.02 | 9.32f.1 | In the context around line 2 page 139, the terminlogies, Non-AP STA and AP are used. However, in one important sentence, "the STA may sleep", where STA is used. Is it an AP STA or a non-AP STA? | Make the following changes:1). in line 2 page 139, change "the STA may sleep" to "the non-AP STA may sleep".2). In line 3 page 139, change "the STA" to "the non-AP STA" | Revise – TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 668. |
| 667 | Ronald Murias | 138.40 | 9.32f.1 | Similarly, Which frame will be used for an AP STA to carry the TWT element in the paragraph in line 40 page 138?A similar issue is in line 57 page 138. | Provide clarificaiton to address the question asked in this comment regarding which frame will be used to carry the TWT element in following places:1). In the paragraph in line 40 page 138;2). In the sentence in line 57 page 138. | Revise - TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 667. |
| 666 | Ronald Murias | 138.36 | 9.32f.1 | Which frame will be used for a non-AP STA to carry the TWT element in the paragraph in line 36 page 138? | Provide clarificaiton to address the question asked in this comment regarding which frame will be used to carry the TWT element in the paragraph in line 36 page 138. | Reject – the frame format clause (8) clearly describes all frames that can carry the TWT IE. If language were to be included here that lists the frames, it is unnecessarily redundant and only creates more questions that are already answered in other places in the draft – i.e. which frame is the right frame from the list of frames – and the answer is dependent upon the situation – use an association frame if you want to make the request for TWT at the same time as during an association, use the TWT Setup action frame if you want to make the request after association. This information is already implicitly included in the existing rules regarding these frames – there is no value in adding a list of frames that could easily become out of synch with the frames that can actually carry the element. There is no reason why the description needs to include the level of resolution requested in this location. |
| 670 | Ronald Murias | 139.13 | 9.32f.1 | The sentence in line 13 page 139 is not useful and also problematic, for multiple reasons, e.g.,1). It uses "should", just a recommendation; however, it also uses "only", actually enforcing constraints;2). We cannot mandate TWT STAs only transmitting/receiving during TWT SPs, as they should be allowed to access the channel in any abnormal operation mode, e.g., emergency situation. | Delete the sentence in line 13 page 139. | Reject – “should” is accepted specification language and has specific meaning within an 802.11 standard, that the following behavior is a recommendation. Hundreds of instances of should appear in the baseline document. 57 instances of “should not” appear in the baseline, and it can easily be argued that “should not” is as restrictive, or moreso, than “should only”. Admittedly, there is only one instance of “should only” in the baseline, but there is nothing wrong with making such a recommendation in the draft. “should only” does not create a constraint, since the verb is still “should” and does not magically change to “shall” when the “only” is added. The commenter provides exactly the justification needed for using “should” instead of “shall” in part 2) of the comment. |
| 671 | Ronald Murias | 139.46 | 9.32f.2 | In line 46 page 139, does "transmit a frame" mean any frame or a specific frame? | Please clarify which frame is transmitted in line 46 page 146. | Revise - TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 671. |

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| 672 | Ronald Murias | 139.45 | 9.32f.2 | In the sentence in line 45 to 47 on page 139, "may" is used, which leaves another possibility, i.e., the Explicit TWT STA has not received its next TWT time, but it does not transmit a frame to request it, then what happens in this case? The Explicit TWT STA keeps awake and waiting for the next TWT time info from the AP? | Please clarify what happens if an Explicit TWT STA has not received the next TWT time info and also it does not send a frame to request it. | Revise - TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 672. |

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| 669 | Ronald Murias | 139.10 | 9.32f.1 | In subsection 8.4.2.170j and subsection 9.32f.2, the non-implicit TWT is referred to as explicit TWT. Why not use the terms in a consistent way? | In line 10 page 139, change the two occurrences of "non-implicit" to " explicit". | Revise - TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 669. |

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| 343 | Matthew Fischer | 34.51 | 8.3.1.20c | This partial timestamp is only 4 octets, as oppposed to the one that it references, which is 5 octets. So maybe the definition needs to be nearly repeated with five changed to four - and it seems like the name of the field should be changed since otherwise, there would be multiple definitions of a field called "partial timestamp" each of which is slightly different - on the other hand, maybe we can allow the use of the exact same name in different frames to mean something slightly different, i do not really know what would be acceptable in this case. | As per the comment - note that several frames contain a field called "partial timestamp" or even just "timestamp" - many of which are different from each other in the number of bytes and which particular bytes of the TSF they contain - something should be done to make the names be consistent with their differences. | Revise - TGah editor to make changes shown in doc 11-13-1143r0 under the heading that includes CID 343. |

**CID 647, 442, 440, 443, 452, 314, 894, 564, 558, 668, 667, 672, 669, 343, 671**

**Discussion:**

Greek:

Tetramer Timestamp

Pentamer Timestamp

Greekier:

Tetramer Chronostamp

Pentamer Chronostamp

Greeklish:

Tetrapartial Timestamp

Pentapartial Timestamp

**Proposed changes:**

***TGah editor, modify the indicated paragraph of subclause 8.2.4.1.1 General, as shown:***

**8.2.4.1.1 General**

The Next TWT Present field is 1 bit in length and is set to 1 if the Next TWT field is present in the frame. Otherwise, it is set to 0.

***TGah editor, modify the following paragraphs of subclause 8.3.1.20a TACK frame format as shown:***

**8.3.1.20a TACK frame format**

The Beacon Sequence field contains the current value of the Change Sequence variable of the transmitting STA.

 The Pentapartial Timestamp field contains the least significant five bytes of the TSF timer value of the transmitting STA at the time that the data symbol containing the first bit of the Pentapartial Timestamp value is transmitted to the PHY plus the transmitting STA’s delays through the local PHY from the MAC-PHY interface to its interface with the WM.

The Next TWT field contains the value of the TSF timer corresponding to the next scheduled TWT SP for the STA that is the intended recipient of the frame. The Next TWT field is optionally present if the Next TWT Present field is set to 1 in the FC field. Otherwise, the field is not present in the TACK frame.

***TGah editor, change all references to the TACK frame field Partial Timestamp to “Pentapartial Timestamp” throughout the draft, including within figure in 8.3.1.20a TACK frame format.***

***TGah editor, add an entry in Table 8-295am (S1G Action field values) within subclause 8.5.23a.1 S1G Action field as per the example shown below:***

**8.5.23a.1 S1G Action field**

|  |  |  |
| --- | --- | --- |
| **Value** | **Meaning** | **Time priority** |
| TBD | TWT Teardown | No |

***TGah editor, insert a new subclause to appear after subclause 8.5.23a.8 TWT Setup frame format as shown:***

**8.5.23a.9 TWT Teardown frame format**

The TWT Teardown frame is an Action frame of category S1G. It is sent by a STA to request the teardown of a TWT agreement and is transmitted by either STA of an existing TWT agreement. The action field of the TWT Setup frame contains the information shown in Table 8-xxxx (TWT Teardown frame action field format).

**Table 8-xxxx—TWT Teardown frame action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | S1G |
| 3 | TWT Flow Field |

The category field is set to the value for S1G specified in Table 8-38 (Category values).

The S1G Action field is set to the value for TWT Teardown frame specified in Table 8-295am (S1G Action field values).

The TWT Flow Field contains the TWT Flow Identifier field and 5 reserved bits as shown in figure 8-xxx TWT Flow Field format:

|  |  |  |
| --- | --- | --- |
|  | TWT Flow Identifier | Reserved |
| Bits: | B0 B2 | B3 B7 |

**Figure 8-xxx TWT Flow Field format**

The TWT Flow Identifier field is defined in 8.4.2.170j Target Wake Time element. In a TWT Teardown frame, the TWT Flow Identifier field is set to the value of the TWT Flow Identifier of the TWT element in the frame that successfully concluded the setup of the TWT that is the subject of the teardown request.

***TGah editor, insert the following paragraphs into subclause 8.7.4.1 STACK frame format as shown:***

**8.7.4.1 STACK frame format**

When the STACK frame is transmitted by a non-AP STA that is associated with an infrastructure BSS, the TA field contains the AID of the STA transmitting the STACK frame, otherwise, the TA field contains a partial BSSID.

The Tetrapartial Timestamp field contains the least significant four bytes of the TSF timer value of the transmitting STA at the time that the data symbol containing the first bit of the Pentapartial Timestamp value is transmitted to the PHY plus the transmitting STA’s delays through the local PHY from the MAC-PHY interface to its interface with the WM.

***TGah editor, change all references to the STACK frame field Partial Timestamp to “Tetrapartial Timestamp” throughout the draft, including within figure in 8.7.4.1 STACK frame format.***

**8.7.4.2 BAT frame format**

***TGah editor: Within subclause 8.7.4.2 BAT frame format and within 8.7.5.1 Format of Short Management frames please change the name of the subfield “Partial Timestamp” and all references in the draft that refer to these instances of this subfield to “Pentapartial Timestamp” and add the sentence shown to each of these subclauses:***

The Pentapartial Timestamp is defined in 8.3.1.20a (TACK frame format).

***TGah editor, change the indicated paragraphs of 9.32f and its subclauses as shown:***

**9.32f Target Wake Time**

**9.32f.1 TWT overview**

Target Wake Times (TWTs) allow an AP to manage the activity in the BSS to minimize contention and to reduce the required amount of time that a STA utilizing a power management mode needs to be awake to exchange frames with other STAs. The principle mechanism to facilitate TWT is the assignment of specific times for a participating STA (TWT STA) to wake to access the medium. TWT STAs need to communicate their wake requirements to APs and APs need to devise a schedule and deliver TWT values to STAs. During a TWT, the AP can send information about the next TWT to each participating TWT STA. When a TWT STA wakes and performs a frame exchange, it receives the next TWT information if Explicit TWT is being used, otherwise, the TWT STA can calculate each next TWT in a implicit series of TWT values. Individual STAs need not be made aware of the TWT values of other STAs. There are no restrictions on TWT values assigned to each STA. The maximum number of outstanding TWT values assigned by one STA to a second STA cannot exceed 8, since the TWT Flow ID field of the TWT IE comprises 3 bits. APs may protect TWT times with protection mechanisms including, but not limited to NAV-setting frame exchanges and RAW scheduling.

A non-AP STA 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.

An AP with dot11TWTOptionActive set 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. If the STA receives a TWT response to a TWT request with the TWT Command value of Accept TWT, then the STA becomes a TWT STA and the STA may sleep until 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.

An AP may transmit a TWT element in a TWT Setup frame to an associated non-AP STA 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.

A non-AP STA with dot11TWTOptionActive set to true shall transmit a TWT element to the AP 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 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. If the AP receives a TWT response to a TWT request with the TWT Command value of Accept TWT from all of its associated non-AP STAs, then the AP becomes a TWT STA and the AP may sleep, depending on PM mode (10.2.1.19), until the TSF matches the TWT value, provided that the AP has indicated that it is in a power save mode.

If the NDP Paging field was not present during the TWT setup, a TWT STA shall be in the awake state for at least the Nominal Minimum Wake Duration time associated with a TWT Flow Identifier following a TWT associated with that TWT Flow Identifier even if no PS-Poll or U-APSD trigger frame has been transmitted by the STA. The time during which the TWT STA is awake is a TWT Service Period (TWT SP). A TWT SP associated with an implicit TWT is an implicit TWT SP. A TWT SP not associated with an implicit TWT is an Explicit TWT SP. If the NDP Paging field was present during the TWT setup, the TWT STA shall follow the rules defined in 9.32f.5 (NDP Paging Setup).

A TWT STA should transmit frames only within TWT SPs.

A TWT STA that transmits a frame during a TWT SP uses the normal rules for transmission (see clause 9 MAC sublayer functional description and 10.2.1.2 STA Power Management modes).

A single pair of STAs can create multiple TWT agreements. Each unique TWT agreement is identified by a Flow Identifier. Because the TWT Flow ID field is 3 bits in length, the maximum number of TWTs per STA is 8. There are no explicit restrictions on the use of any specific TWT (e.g. EDCA AC restrictions) when multiple TWTs have been assigned to a single STA.

The MAC parameter Adjusted Minimum Wake Duration is equal to (Nominal Minimum Wake Duration + 40×10-6 × Wake Interval).

A TWT STA may wake to receive Beacons, but is not required to do so.

An AP 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 an unannounced TWT for that STA.

**9.32f.2 Explicit TWT operation**

An AP that receives a frame from a TWT STA during an Explicit TWT SP shall respond to the STA with a frame that contains a Next TWT field (e.g. BAT, TACK, STACK) if it has not already transmitted a Next TWT field to the STA within this TWT SP. If the AP has already transmitted a Next TWT field to the STA within this TWT SP, the AP may respond to the STA with a frame that contains a Next TWT field. When present in the response frame, the Next TWT field shall 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.

A TWT STA awake for an Explicit TWT SP shall not transition to doze state until it has received a Next TWT field from the AP and has been in the awake state for at least Adjusted Minimum Wake Duration time from the TWT SP start time as identified by the TWT STA or has received an EOSP field with a value of 1. If more than one Next TWT field is received from the AP during a TWT SP, the STA shall discard all but the most recently received value. If no Next TWT field is received from the AP during the TWT SP, then following the end of the TWT SP when not otherwise prohibited from transmitting, the STA may transmit any frame that is addressed to the AP , to solicit a response that contains a Next TWT value. If such a 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 transmisison until it receives the expected response from the AP. The AP shall assume that the TWT STA is in the doze state if the TWT SP has ended, the TWT STA is in a Power Save mode and the AP has not received a frame from the TWT STA that solicits a response that contains a Next TWT value. If the AP receives a frame from the TWT STA that solicits a response that contains a Next TWT value, the AP shall queue for transmission, the appropriate response frame with a Next TWT value and assume that the STA is in the awake state until the AP has transmitted the response frame.

**9.32f.3 Implicit TWT operation**

A TWT STA operating in an Implicit TWT SP shall determine the next TWT SP start time by adding to the current TWT, the value of Wake Interval associated with this TWT SP.

A TWT STA awake for an Implicit TWT SP may transition to the doze state after Adjusted Minimum Wake Duration time has elapsed from the TWT SP start time as identified by the TWT STA.

An AP that receives a frame from a TWT STA for an Implicit TWT may respond to the STA with a frame that contains a Next TWT field (e.g. BAT, TACK, STACK). A TWT STA that is awake for an Implicit TWT SP and receives a frame with a Next TWT field from its AP shall use the received Next TWT 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 are calculated based on the next TWT that was sent by the AP.

***TGah editor, insert a new subclause after the end of subclause 9.32f.6 TWT Sleep Setup as shown:***

**9.32f.7 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 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 of the TWT Teardown frame is deleted.

**References:**