IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LB205 TWT SST CIDs not group TWT | | | | |
| Date: 2015-01-05 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Matthew Fischer | Broadcom | 190 Mathilda Place, Sunnyvale, CA 94086 | +1 408 543 3370 | [mfischer@broadcom.com](mailto:mfischer@broadcom.com) |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Abstract

This document proposes a resolution for CIDs relating to the TWT Information Element and the TWT behavioural subclauses and the SST element and behavioral subclauses.

**REVISION NOTES:**

R0: initial

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 “Instruction to 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:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 5002 | Shusaku Shimada | 144.06 | 8.4.2.170j | In Figure 8-575h2&#129;\Request Type field format, the sub field name of "Wake Interval Exponet" should use same notation as "TWT Wake Interval Mantissa". | Add "TWT" as "TWT Wake Interval Exponent". | Accept – Tgah editor to add “TWT” to the field name in the Request Type field format diagram. Note that the name is correct in other locations. |
| 5003 | Shusaku Shimada | 146.36 | 8.4.2.170j | "The Zero Offset of Group subfield is optionally present in the TWT Group Assignment field and when a STA transmits multiple TWT requests for multiple TWT flows, the next TWT Group Assignment field might not include the Zero Offset of the Group subfield implying that the Zero Offset of the Group subfield is the same for each of the TWT flows." is not clear enough. | Modify as "The Zero Offset of Group subfield is optionally present in the TWT Group Assignment field because a STA may transmit multiple TWT requests for multiple TWT flows expecting that the Zero Offset of Group subfield is same for each of the TWT flows. When a STA may transmit multiple TWT requests for multiple TWT flows, the TWT Group Assignment field in the responding frames other than responding to first requst, may not include the Zero Offset of Group subfield implying that the Zero Offset of Group subfield for each TWT flow is same as the latest value assigned in responding frames." | Revise – generally agree with commenter, Tgah editor to execute proposed changes found in document 11-15-xxxxry under all headings that include CID 5003. |
| 5023 | Shusaku Shimada | 286.38 | 9.42a1 | "..., provided that the STA has indicated that it is in a power save mode and no other condition requires the STA to remain awake." need an example to clarify. | Append an example as "..., provided that the STA has indicated that it is in a power save mode and no other condition requires the STA to remain awake, e.g. no STACK is required to transmit, or no further requests for different TWT flows to send are existing even if the TWT requesting STA transmits S1G Capabilities element with the TWT Grouping Support subfield equal to 1." | Reject – there are many reasons for a STA to remain awake, some of which are included in subclauses scattered throughout the standard and its amendments and some of which are part of the TGah draft amendment and some of which are not requirements of the standard, but are choices on the part of an implementation. There is no value in attempting to provide a full or partial list of these reasons. The commenter has suggested a partial list containing only a few items which are relevant to this amendment, but the inclusion of such a partial list might give some readers the impression that other reasons that arise from other subclaues in the specification might therefore be exempt from the action described here. |
| 5024 | Shusaku Shimada | 289.28 | 9.42a.3 | "If the TWT responding STA has already transmitted a non-zero Next TWT Info/Suspend Duration field ....., the TWT responding STA may respond to the STA with a frame that contains a Next TWT Info/Suspend Duration field." is not clear enough. | Append "Even" as "Even if the TWT responding STA has already transmitted a non-zero Next TWT Info/Suspend Duration field ..., the TWT responding STA may respond .... field." | Reject – the commenter’s suggestion is to add an adverb which will change the language from being purely descriptive to a more editorial form by unnecessarily emphasizing the stipulated condition. E.g. why does “even” not appear in all instances of “if” that are followed by a clause that includes a normative verb? Which ones should include it and which should not? |
| 5037 | MARC EMMELMANN | 304.02 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5038 | MARC EMMELMANN | 304.03 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5039 | MARC EMMELMANN | 304.04 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5040 | MARC EMMELMANN | 304.34 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5041 | MARC EMMELMANN | 304.35 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5042 | MARC EMMELMANN | 306.27 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5043 | MARC EMMELMANN | 306.25 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5044 | MARC EMMELMANN | 306.31 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5045 | MARC EMMELMANN | 306.35 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5046 | MARC EMMELMANN | 306.61 | 9.42f | "(short) beacon interval" -- using this wording seems to require to introduce a new abbreviation which could easily be avoided by using "short beacon interval or beacon interval". This would alse prevent the use of parenthathes. | Replace "(short) beacon interval" with "short beacon interval or beacon interval" | Reject – the current form is more compact and satisfies the larger number of voters and there is nothing wrong with adding an abbreviation – we have a subclause dedicated for that very purpose. |
| 5071 | MARC EMMELMANN | 144.23 | 8.4.2.170j | Table 8-258a2 -- usually, values are not given in binary format but to base 10. Same in Table 8-258a3 same in Table 8-258a7 and Table 8-418 and Table 8-419 | Change all values in first column of table to base 10 | Revise – generally agree with commenter, except that tables 8-258a7, 8-418 and 8-419 conform to the style of one of the oldest tables in the 802.11 standard, table 8-1 valid type and subtype combinations where individual bits are named in the column heading, Tgah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5071. |
| 5072 | MARC EMMELMANN | 145.40 | 8.4.2.170j | use of is set to : the value of the field is addressed and not the act of changing it. | replace "is set to" with "is equal to" | Accept – Tgah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5072. |
| 5073 | MARC EMMELMANN | 160.01 | 8.4.2.170l | "The Sounding Option subfield is set to 0 to indicate" -- value of field is important not the act of changing it to 0. Similar issue at 160.18 and 160.24 and 161.15 | Change to "A Sounding Option subfield equal to 0 indicates" | Reject – there are at least 120 instances of the cited phrasing in the baseline standard, so the group prefers that a centralized style authority makes a decision on the question to apply to all amendments before accepting the proposed change while also noting that in many instances in both the baseline and the draft amendment, the converse of a condition indicated by a particular value is easily contraindicated by the phrase “otherwise, the bit is set to x”, but there is no convenient, concise, equivalent phrase that can be used to express the converse condition if the suggested alternative phrasing is used. |
| 5104 | Shusaku Shimada | 147.46 | 8.4.2.170j | "Each bit in the bitmap corresponds to one minimum width channel (see 8.4.3.170y (SST Operation element)) 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." is not clear enough unless the minimum channel width means 1MHz or 2MHz, i.e. SST Channel Unit information in SST Operating Eleent is required. | Change to "Each bit in the bitmap corresponds (see 8.4.3.170y (SST Operation element)) to one minimum width channel (that is 1MHz or 2MHz as indicated in Primary Channel Number subfield of S1G Operating Element) 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." | Revise – generally agree with commenter, TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5104. |
| 5185 | Liwen Chu | 144.32 | 8.4.2.170j | There is no TWT field in the element. Full name of the field should be used. | As in comment | Revise – generally agree with commenter, TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5185. |
| 5186 | Liwen Chu | 144.44 | 8.4.2.170j | "TWT group parameters that are different from ... TWT parameters"    Which one is really talking about TWT group parameters or TWT parameters? | Clarify it. | Reject – requesting STA never requests TWT group parameters, but response can use TWT group parameters. |
| 5187 | Liwen Chu | 144.50 | 8.4.2.170j | Why is the suggested/demanded parameter only TWT value and the responder needs to accept a set of parameters? | Make the scope of suggested/demanded parameters same as the accepted parameters. | Revise – generally agree with commenter, TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5187. |
| 5190 | Liwen Chu | 161.40 | 8.4.2.170l | "...after the transmission of the Beacon frame containing the SST element."    The decoding of element is higher MAC layer. STAs do not know SST element right after Beacon carrying SST element. | Always use Start Time subfield. | Reject – how long does it take to decode the element? There are many “correct” answers to this question and the commenter has not provided even one answer to the question, so it is impossible to know what minimum Start Time value should be mandated. Furthermore, it is possible for any STA interested in the sounding to simply stay awake immediately after the Beacon in case sounding starts and during the sounding, the element decoding can proceed. |
| 5191 | Liwen Chu | 161.01 | 8.4.2.170l | "...at the end of the transmission of the frame containing the SST element"    The decoding of element is higher MAC layer. STAs do not know SST element right after the frame containing the SST element. | Always use Start Time subfield. | Reject – how long does it take to decode the element? There are many “correct” answers to this question and the commenter has not provided even one answer to the question, so it is impossible to know what minimum Start Time value should be mandated. Furthermore, it is possible for any STA interested in the sounding to simply stay awake immediately after the Beacon in case sounding starts and during the sounding, the element decoding can proceed. |
| 5258 | Alfred Asterjadhi | 145.36 | 8.4.2.170j | Please replace "TWT-requesting STA" with "TWT requesting STA" throughout the draft to keep consistency. | As in comment. | Accept |
| 5259 | Alfred Asterjadhi | 146.10 | 8.4.2.170j | The "Zero Offset of Group" subfield is optional. So replace "48" with "0 or 48". | As in comment. | Revise – generally agree with commenter, TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5259. |
| 5260 | Alfred Asterjadhi | 147.33 | 8.4.2.170j | Is the frame exchange expected to be completed during one TWT SP? Also I have noticed the use of "TWT ID", "Flow Identifier", "TWT Flow ID" and "TWT Flow Identifier", and TWT Identifier" likely for the same parameter. Possibly replace all of these terms with "TWT Flow Identifier" throughout the draft. Including when used in plural. | As in comment. | Accept – TGah editor to execute proposed changes provided by the commenter and the commeter is to note that the frame exchange is expected to be completed during one TWT SP, if not, then the flow will fall behind and fail. |
| 5261 | Alfred Asterjadhi | 147.49 | 8.4.2.170j | The bit in the bitmap can correspond to one minimum width channel from the enabled SST subchannels in the SST BSS as well. Replace " BSS" with "BSS or SST BSS" here and in the next line. | As in comment. | Reject – an SST BSS is a BSS and therefore is already included in the term “BSS”. |
| 5262 | Alfred Asterjadhi | 148.01 | 8.4.2.170j | Only an AP can schedule RAWs. But this condition that was present in D2.0 is not present in D3.0. Insert " that is an AP" immediately after "TWT responding STA". | As in comment. | Accept – TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5262. |
| 5263 | Alfred Asterjadhi | 148.27 | 8.4.2.170j | Minor clarification: Replace "Max NDP Paging period" with "Max NDP Paging Period field". Also TWT interval does not appear anywhere else in the draft. I think this refers to "TWT Wake Interval". So replace "TWT interval" with TWT Wake Interval". | As in comment. | Accept – TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5263. |
| 5264 | Alfred Asterjadhi | 148.48 | 8.4.2.170j | This table lists actions and for value 2 and 3 it the wording can be inline with the other values (and the NDP Paging procedure subclause) by replacing "STA" with "Wake up". Also in P148L64 it is not needed to specify that the Bits 30-31 are reserved as this is already shown in figure 8-575a24. So remove the sentence in P148L64. | As in comment. | Accept – TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5264. |
| 5272 | Alfred Asterjadhi | 181.22 | 8.4.2.170y | There is no need to specify that the Reserved field is 4 bits. Similarly there is no need to say what is the bit length of the fields. The figure already shows that. | Remove this sentence. Also remove any occurrence of "is x bits and" from this subclause. | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5302 | Alfred Asterjadhi | 286.17 | 9.42a.1 | The subfield in the S1G Capabilities element is called "TWT Responder Support". Please replace "TWT Responder" with "TWT Responder Support". Idem for replacing "TWT responder Support" with TWT Responder Support" throughout the draft. Another clarification in the paragraph that follows in P286L23: it is confusing to say " a STA with which it is associated" because the STA is associated with the AP not the other way around. So replace "with which it is associated" with "that is associated to the AP". | As in comment. | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5303 | Alfred Asterjadhi | 287.32 | 9.42a.1 | I think "Adjusted Nominal Minimum Wake Duration" is the same parameter as "AdjustedMinimumTWTWakeDuration". Idem for "adjusted nominal minimum wake duration". For consistency use the same term for this parameter: "AdjustedMinimumTWTWakeDuration" throughout the draft. | As in comment. | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5304 | Alfred Asterjadhi | 287.55 | 9.42a.1 | The TWT requesting STA can be an AP so it should be clear that this AP still follows the rules for generating beacons, being in power save mode, etc. Similar observation for the text in 9.42.a.7 (TWT Sleep Setup) regarding the responder STA where the same behavior should be clear as well by referring to the corresponding subclauses as suggested in the proposed change. | Insert " that is a non-AP STA" after "TWT responding STA". And insert the following sentence immediately after the first sentence of this paragraph: "A TWT requesting STA that is an AP generates S1G Beacon frames as described in 10.1.3 (Maintaining synchronization" and operates in power save mode as described in 10.2.2.20 (AP Power Management). | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5305 | Alfred Asterjadhi | 287.62 | 9.42a.1 | This should be TWT Wake Interval. Replace "Wake Interval" with "TWT Wake Interval". I noticed tha same in a couple of other places (e.g., P290L64) as well so perform the change throughout the draft. | As in comment. | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5306 | Alfred Asterjadhi | 288.41 | 9.42a.2 | This paragraph is a duplicate of the second paragraph of 9.42a.1. Please remove it. | As in comment. | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5307 | Alfred Asterjadhi | 290.58 | 9.42.a.4 | During an implicit TWT, the TWT responding STA may provide the next TWT via a TWT Information frame as well. | Add the missing case. | Accept – TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5307. |
| 5317 | Alfred Asterjadhi | 303.41 | 9.42f | Grammatical error (singular not plural). | Replace "channels" with "channel". | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5318 | Alfred Asterjadhi | 304.02 | 9.42f | The description of SST operation is quite sparse at this point and difficult to follow. In my understanding an SST AP can setup an SST BSS or use the existing BSS to identify the enabled SST channels. And then the SST AP can signal which are allowed to be accessed during a (short) beacon interval with the SST element (here) or with the RPS element when SST STA supports RAW (described in 9.22.5.1). The allowed SST channels can also be indicated via a TWT element (described in 9.42a) and can also be periodically setup using the RPS element (described in 9.42g.1). I think SST would really benefit from some organization and adding references to the subclauses when the signaling is provided via other elements. | Suggest to have one subclause here that gives an Overview of the SST operation and SST BSS setup. Then describe that from the enabled SST channnels (picked either from the BSS operation or from the SST operation element) the AP signals the SST channels that are allowed to be used every (short) beacon interval by the SST STA via the SST element as described in (a subclause that follows this one: maybe calling it Basic SST operation?) or via the RPS element as described in 9.22.5.1. And refer to the signaling with TWT element when these STAs have negotiated TWT operation and to the Periodinc SST operation subclause for the periodic case. Also suggest keeping consistency between the language used in these subclauses. | Revise – generally agree with commenter, TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5318. |
| 5319 | Alfred Asterjadhi | 304.63 | 9.42f | DL bit? I think this is DL Activity field. I noticed some similar inconistencies. Please check that the field names are inline with the elements descriptions. | As in comment. | Revise – generally agree with commenter, TGah editor to execute proposed changes found in document 11-15-0083r0 under all headings that include CID 5319. |
| 5447 | David Hunter | 160.05 | 8.4.2.170l | The fragment "bitmap indicating on which channels there is expected or permitted to be transmission activity at a given time", which is in the definitions clause 8, is confusing but also contains a veiled requirement. "Permit" is allowed in a definition when the definition is for a term that means some other entity is permitting, or not, a certain action. However, in this case the defined term might directly control allowed activity. Also: the "expected or permitted" makes the definition vague at best -- which is it? Do the bits indicate expecctations or specify permissions? | Replace "or permitted" with "or permitted by the AP". Also, for clarity, replace "indiicating on which channels there is expected or permitted to be transmission activity at a given time" with "indicating on whiich channels transmission is either expected or permitted by the AP during a given time period". | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5448 | David Hunter | 160.18 | 8.4.2.170l | The fragment "to indicate that STAs associated with the SST AP that transmits the SST element are permitted to transmit frames" is ambiguous about what is doing the indicated permitting. | Replace "to indicate that STAs associated with the SST AP that transmits the SST element are permitted to transmit frames"  with  "to indicate that the SST AP (that transmits the SST element) permits the STAs associated with it to transmit frames". | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5449 | David Hunter | 160.30 | 8.4.2.170l | The fragment "indicates the maximum permitted PPDU bandwidth for a transmission on the indicated channel" is ambiguous as to whether the indicated permission is a matter of regulation, definition of MCS, limit of each STA, or what. | Replace "indicates the maximum permitted PPDU bandwidth for a transmission on the indicated channel" with "indicates the maximum PPDU bandwidth permitted by the AP for a transmission on the indicated channel". | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5453 | David Hunter | 289.24 | 9.42a.3 | The phrase "to be sent in response the TWT responding STA shall respond with" is confusing. Just what is associated with what here? | Replace "to be sent in response the TWT responding STA shall" with "to be sent in response, then the TWT responding STA shall". | Accept – TGah editor to execute proposed changes provided by the commenter. |
| 5482 | Joseph Levy | 160.05 | 8.4.2.170I | There are two paragraphs describing the setting of Channel Activity Bitmap, one of page 160 and page 161. It is not very clear from the paragraphs directly why the descriptions are different. | Add clarifying language such as "When Sounding Option is 0" to the first paragraph, and add "When Sounding Option is 1" to the second paragraph. | Accept – TGah editor to execute proposed changes provided by the commenter. |

**Discussion:**

xxxx

**Proposed changes**

The proposed changes are all referenced to draft P802.11ah\_D3.1.

**CID 5002, 5003, 5071, 5072, 5104, 5185, 5187, 5259, 5262, 5263, 5264**

***TGah editor: modify the text and figures as shown:***

**8.4.2.196 TWT element**

The TWT element is shown in Figure 8-575a20 (TWT element format).

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |
|  | Element ID | Length | Control | Request Type | Target Wake Time | TWT Group Assignment | Nominal Minimum Wake Duration | TWT Wake Interval Mantissa | TWT Channel | NDP Paging (optional) |
| Octets: | 1 | 1 | 1 | 2 | 8 or 0 | 9 or 3 or 0 | 1 | 2 | 1 | 0 or 4 |

**Figure 8-575a20—TWT element format**

The Element ID and Length fields are defined in 8.4.2.1 (General).

The format of the Control field is shown in Figure 8-401dd (Control field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B1 | B2 | B3 B8 |
|  | NDP Paging Indicator | Responder PM Mode | Reserved |
| Bits: | 1 | 1 | 6 |

**Figure 8-575a21—Control field format**

The NDP Paging field is present if the NDP Paging Indicator subfield is equal to 1; otherwise the NDP Paging field is not present.

The Responder PM Mode subfield indicates the Power Management mode as defined in 10.2 (Power management).

The format of the Request Type field is shown in Figure 8-575a22 (Request Type field format).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 B3 | B4 | B5 | B6 | B7 B9 | B10 B14 | B15 |
|  | TWT Request | TWT Setup Command | Reserved | Implicit | Flow Type | TWT Flow Identifier | TWT Wake Interval Exponent | TWT Protection |
| Bits: | 1 | 3 | 1 | 1 | 1 | 3 | 5 | 1 |

**Figure 8-575a22—Request Type field format**

A STA that transmits a TWT element with the TWT Request subfield equal to 1 is a TWT requesting STA. A STA that transmits a TWT element with the TWT Request subfield equal to 0 is a TWT responding STA.

The TWT Setup Command subfield values indicate the type of TWT command, as shown in Table 8-258a2 (TWT Setup Command field values).

Table 8-258a2—TWT Setup Command field values

|  |  |  |  |
| --- | --- | --- | --- |
| **TWT Setup Command field value** | **Command name** | **Description when transmitted by a TWT requesting STA** | **Description when transmitted by a TWT responding STA** |
| 0 | Request TWT | The Target Wake Time field of the TWT element contains zeros 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. | 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. | 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. | N/A |
| 3 | TWT Grouping | N/A | 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 | TWT responding STA accepts the TWT requeset with the TWT parameters\* indicated |
| 5 | Alternate TWT | N/A | TWT responding STA suggests TWT parameters that are different from TWT requesting STA suggested or demanded TWT parameters |
| 6 | Dictate TWT | N/A | TWT responding STA demands TWT paframeters that are different from TWT requesting STA suggested or demanded TWT parameters |
| 7 | Reject TWT | N/A | TWT responding STA rejects TWT setup |
| \*TWT Parameters are: TWT, Nominal Minimum Wake Duration, TWT Wake Interval and TWT Channel subfield values indicated in the element. | | | |

When transmitted by a TWT requesting STA, the Implicit subfield is set to 1 to request an implicit TWT.

When transmitted by a TWT requesting STA, the Implicit subfield is set to 0 to request an explicit TWT.

The Flow Type subfield indicates the type of interaction between the TWT requesting STA and the TWT responding STA at a TWT. A value of 0 in the Flow Type subfield indicates an Announced TWT in which the TWT requesting STA will send a PS-Poll or an APSD trigger frame (see 10.2.2.5 (Power management with APSD)) to signal its awake state to the TWT responding STA before a frame is sent from the TWT responding STA to the TWT requesting STA. A value of 1 in the Flow Type subfield indicates an Unannounced TWT in which the TWT responding STA will send a frame to the TWT requesting STA at TWT without waiting to receive a PS-Poll or an APSD trigger frame from the TWT requesting STA.

The TWT Flow Identifier 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.

In a TWT element transmitted by a TWT requesting STA, the TWT Wake Interval is equal to the average time that the TWT-requesting STA expects to elapse between successive TWT SPs. In a TWT element transmitted by a TWT responding STA, the TWT Wake Interval is equal to the average time that the TWT-responding STA expects to elapse between successive TWT SPs. 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, the Target Wake Time field contains a positive integer which corresponds to a TSF time at which the STA requests to wake, or a value of zero when the TWT Setup Command subfield contains the value corresponding to the command “Request TWT”. When a TWT responding STA with dot11TWTGroupingSupport equal to 0 transmits a TWT element to the TWT requesting STA, the TWT element contains a value in the Target Wake Time field which corresponds to a TSF time at which the TWT responding STA requests the TWT-requesting STA to wake and it does not contain the TWT Group Assignment field.

When a TWT responding STA with dot11TWTGroupingSupport equal to 1 transmits the TWT element to the TWT requesting STA from which it received a frame containing an S1G Capabilities element with the TWT Grouping Support subfield equal to 1, the TWT element does not contain the Target Wake Time field and it does contain the TWT Group Assignment field in order to indicate the TWT group of the requesting STA and the assigned TWT value. The presence of the TWT Group Assignment field is indicated by a TWT responding STA by using the TWT Grouping command in the TWT Setup Command subfield (see Table 8-258a2 (TWT Setup Command field values)) within the TWT element.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B6 | B7 | B8 B55 | B56 B59 | B60 B71 |
|  | TWT Group ID | Zero Offset Present | Zero Offset of Group (optional) | TWT Unit | TWT Offset |
| Bits: | 7 | 1 | 48 or 0 | 4 | 12 |

**Figure 8-575a23—TWT Group Assignment field format**

The TWT Group Assignment field provides information to a requesting STA about the TWT group to which the STA is assigned. This field contains the TWT Group ID, Zero Offset of Group (optional), TWT Unit, and TWT Offset subfields. The TWT Group Assignment field and the corresponding subfields are depicted in Figure 8-575a23 (TWT Group Assignment field format).

The TWT Group ID subfield is a 7-bit unsigned integer and indicates the identifier of the TWT group to which the requesting STA is assigned. A TWT group is a group of STAs that have TWT values that lie within a specific interval of TSF values. A value of 0x00 in the TWT Group ID subfield is used to indicate the unique TWT group which contains all STAs in the BSS.

The value in the Zero Offset Present subfield indicates whether the following Zero Offset of Group subfield is included in the TWT Group Assignment field of the TWT element. A value of 0 in the Zero Offset Present subfield indicates that the Zero Offset of the Group subfield is not included in the TWT Group Assignment field.

The Zero Offset of Group subfield indicates the initial TWT value for the TWT group identified by the TWT group ID. The Zero Offset of Group subfield is six octets and contains the initial TWT value for the TWT group with the given TWT group ID. When the Zero Offset of Group subfield is present, it contains the lowest six octets of the TSF time corresponding to the TWT group offset time. The Zero Offset of Group subfield is optionally present in the TWT Group Assignment field. If a STA transmits multiple TWT requests for multiple TWT flows, the next TWT Group Assignment field transmitted in a response to a TWT request can optionally exclude the Zero Offset of the Group subfield from an included TWT Group Assignment field provided that a previous response included a Zero Offset of the Group subfield. The receipt of a TWT response with a TWT Group Assignment field with no Zero Offset of the Group subfield implies that the Zero Offset of the Group subfield value for that TWT is the same as the Zero Offset of the Group subfield value of the most recently received Zero Offset of the Group subfield from the TWT Responding STA.

The TWT Unit subfield indicates the unit of increment of the TWT values within the TWT group identified by the TWT group ID. The TWT Unit value encoding is shown in Table 8-258a3 (TWT Unit subfield encoding).

**Table 8-258a3—TWT Unit subfield encoding**

|  |  |
| --- | --- |
| **TWT Unit subfield value** | **TWT Unit time value** |
| 0 | 32 usec |
| 1 | 256 usec |
| 2 | 1024 usec |
| 3 | 8.192 msec |
| 4 | 32.768 msec |
| 5 | 262.144 msec |
| 6 | 1.048576 sec |
| 7 | 8.388608 sec |
| 8 | 33.554432 sec |
| 9 | 268.435456 sec |
| 10 | 1073.741824 sec |
| 11 | 8589.934592 sec |
| 12 – 15 | Reserved |

The TWT Offset subfield indicates the position within the indicated group, of the STA corresponding to the RA of the frame containing the TWT element.

A non-AP STA uses the TWT Group ID, Zero Offset of Group, TWT Unit, and TWT Offset subfield values to compute its TWT value within the TWT group. A STA's TWT value is equal to the value of the Zero Offset of Group subfield plus TWT Offset subfield times the value of TWT Unit subfield.

The Nominal Minimum Wake Duration field contains the minimum amount of time that the TWT-requesting STA expects that it needs to be awake in order to complete the frame exchanges associated with the Flow Identifier for the period of TWT Wake Interval, where TWT Wake Interval is the average time that the TWT-requesting STA expects to elapse between successive TWT SPs. The least significant bit of the field corresponds to 256 microseconds.

The TWT Wake Interval Mantissa subfield is set to the value of the mantissa of the TWT Wake Interval value in microseconds, base 2.

When transmitted by a TWT requesting STA, 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, 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 2 MHz if no such element has been previously received from the AP to which the SST STA is associatedA 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.

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 ID 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).

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 value of the TWT Protection subfield to 1 to indicate that the TWT SP(s) corresponding to the TWT ID(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 value of 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).

The format of the NDP Paging field is defined in Figure 8-575a24 (NDP Paging field format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 B8 | B9 B16 | B17 B20 | B21 B23 | B24 B29 | B30 B31 |
|  | P-ID | Max NDP Paging Period | Partial TSF Offset | Action | Min Sleep Duration | Reserved |
| Bits: | 9 | 8 | 4 | 3 | 6 | 2 |

**Figure 8-575a24—NDP Paging field format**

The P-ID field is the identifier of the paged STA, as described in 9.44.6 (NDP Paging Setup).

The Max NDP Paging period field indicates the maximum number of TWT Wake Intervals between two NDP Paging frames.

The Partial TSF Offset field includes timing indications, as described in 9.44.6 (NDP Paging Setup).

Upon reception of an NDP Paging frame with matching P-ID field as defined in 9.44.6 (NDP Paging Setup), the TWT STA that is an NDP Paging requester takes an action indicated by the Action field as described in Table 8-258a4 (Action field).

**Table 8-258a4—Action field**

|  |  |
| --- | --- |
| **Action** | **Options** |
| 0 | Send a PS-Poll or uplink trigger frame |
| 1 | Wake up at the time indicated by Min Sleep Duration |
| 2 | Wake up to receive the Beacon |
| 3 | Wake up to receive the DTIM Beacon |
| 4 | Wakeup at the time indicated by the sum of the Min Sleep duration field and the ASD subfield in the APDI field of the NDP Paging frame |
| 5-7 | Reserved |

The Min Sleep Duration field in the NDP Paging Request indicates in units of SIFS the minimum duration that STA will be in the Doze state after receiving an NDP Paging with matching P-ID.

**8.4.2.198 Subchannel Selective Transmission (SST) element**

The Subchannel Selective Transmission (SST) element is shown in Figure 8-575a29 (Subchannel Selective Transmission element format).

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | Element ID | Length | Channel Activity Schedule |
| Octets: | 1 | 1 | Nx2 of Nx4 |

**Figure 8-575a29—Subchannel Selective Transmission element format**

The Element ID and Length fields are defined in 8.4.2.1 (General).

N is the number of channel activity schedules being provided.

The format of the Channel Activity Schedule subfield is shown in Figure 8-575a30 (Channel Activity Schedule subfield format (Sounding Option = 0)) and Figure 8-575a31 (Channel Activity Schedule subfield format (Sounding Option = 1)).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 B8 | B9 | B10 | B11 B12 | B13 B31 |
|  | Sounding Option (=0) | Channel Activity Bitmap | UL Activity | DL Activity | Maximum Transmission Width | Activity Start Time |
| Bits: | 1 | 8 | 1 | 1 | 2 | 19 |

**Figure 8-575a30—Channel Activity Schedule subfield format (Sounding Option = 0)**

The Sounding Option subfield is set to 0 to indicate that the Channel Activity Schedule field is the AP Activity schedule.

The Channel Activity Bitmap subfield contains a bitmap indicating on which channels there is expected or permitted to be transmission activity at a given time. Each bit in the bitmap corresponds to one minimum width channel for the band of operation with the LSB corresponding to the lowest numbered operating channel of the BSS. A value of 1 in a bit position in the bitmap means that the AP expects activity and/or permits transmissions with bandwidth less than or equal to Maximum Transmission Width and that include that channel, after the time indicated in the Activity Start Time subfield. Only one bit in the bitmap can be set to 1 within each channel activity schedule. The minimum width channel is equal to the SST Channel Unit field of the SST Operation element if such an element has been previously transmitted or is equal to 2 MHz if no such element has been previously received from the AP to which the SST STA is associated.

NOTE—Transmissions need to comply with the channelization for the regulatory domain of operation.

The UL Activity bit is set to 1 to indicate that STAs associated with the SST AP that transmits the SST element are permitted to transmit frames that are not immediate response frames on the channel(s) identified by the Channel Activity Bitmap and Maximum Transmission Width at the time indicated in the Activity Start Time subfield. Otherwise it is set to 0.

The DL Activity bit is set to 1 to indicate that the AP that transmits the SST element intends to transmit frames that are not immediate response frames on the channel(s) identified by the Channel Activity Bitmap and Maximum Transmission Width at the time indicated in the Activity Start Time subfield. Otherwise it is set to 0.

The Maximum Transmission Width field indicates the maximum permitted PPDU bandwidth for a transmission on the indicated channel and cannot exceed the BSS operating channel width specified by the AP in a transmitted S1G Operation element. In order to abide by the rules of each regulatory domain, the maximum operating channel width is limited by the BSS operating channel width even if the Maximum Transmission Width field specifies otherwise. The maximum permitted PPDU bandwidth is in MHz and is determined based on the Maximum Transmission Width subfield as shown in Table 8-258a7 (Mapping between Maximum Transmission Width field and maximum permitted PPDU bandwidth).

**Table 8-258a7—Mapping between Maximum Transmission Width field and maximum per­mitted PPDU bandwidth**

|  |  |
| --- | --- |
| **Maximum Transmission Width (Bit 1 Bit 0)** | **Maximum permitted PPDU bandwidth (MHz)** |
| 0 0 | Channel width unit |
| 0 1 | 4 |
| 1 0 | 8 |
| 1 1 | 16 |
| NOTE – The channel width unit is equal to 1 MHz if the SST Channel Unit field of the most recently received SST Operation element from the SST AP is equal to 1. If no SST Operation element has been received or the SST Channel Unit field of the received SST Operation element is equal to 0 then the channel width unit is equal to 2 MHz. | |

The Activity Start Time subfield contains a value that defines a start time for when the AP expects frame transmissions to begin on the channel(s) indicated in the corresponding Channel Activity Bitmap. The start time is triggered when the 19 least significant bits of the TSF timer for the BSS match the value that is indicated in the Activity Start Time subfield of the SST element. The count down to the start time is initiated at the end of the transmission of the frame containing the SST element.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 B8 | B9 | B10 B13 | B14 B15 | B16 B31 |
|  | Sounding Option (=1) | Channel Activity Bitmap | Sounding Start Time Present | Reserved | Maximum Transmission Width | Sounding Start Time (optional) |
| Bits: | 1 | 8 | 1 | 4 | 2 | 0 or 16 |

**Figure 8-575a31—Channel Activity Schedule subfield format (Sounding Option = 1)**

The Sounding Option subfield is set to 1 in order to indicate that the Channel Activity Schedule field is the SST sounding schedule.

The Channel Activity Bitmap subfield contains a bitmap indicating on which channels there is an SST sounding transmission activity at a given time. Each bit in the bitmap corresponds to one minimum width channel for the band of operation with the LSB corresponding to the lowest numbered operating channel of the BSS. A value of 1 in a bit position in the bitmap means that the AP transmits one more PIFS-separated sounding NDP frames.

The Sounding Start Time Present subfield indicates whether the Sounding Start Time subfield is present in the Channel Activity Schedule field. If the subfield is equal to 1, the Sounding Start Time subfield is present. If this subfield is equal to 0, the Sounding Start Time subfield is not present.

The Maximum Transmission Width subfield indicates the channel bandwidth of the sounding NDP and is shown in Table 8-258a7 (Mapping between Maximum Transmission Width field and maximum permitted PPDU bandwidth).

The Sounding Start Time subfield contains a value that defines a start time when the AP transmits one or more sounding NDP frames on the channel(s) indicated in the corresponding Channel Activity Bitmap. If the Sounding Start Time subfield is not present, the AP transmits one or more PIFS-separated sounding NDP frames starting after the transmission of the Beacon frame containing the SST element. If the Sounding Start Time subfield is present, the AP transmits one or more PIFS-separated sounding NDP frames starting at the time indicated in the Sounding Start Time field. The start time is triggered when the 16 least significant bits of the TSF timer for the BSS match the value that is indicated in the Sounding Start Time subfield of the SST element. The count down to the start time is initiated at the end of the transmission of the frame containing the SST element.

**CID 5307**

***TGah editor: modify the first paragraph of subclause 9.44.4 Implicit TWT operation as shown:***

**9.44.4 Implicit TWT operation**

The TWT values for an implicit TWT are periodic. A TWT requesting STA operating with an implicit 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. A TWT requesting STA operating with an implicit TWT agreement with a TWT ID that matches the TWT ID of a received TWT Information frame from its TWT responding STA shall replace its next TWT SP start time value with the value from the Next TWT subfield of the TWT Information frame.

**CID 5317, 5318, 5319**

***TGah editor: modify the subclause 9.49 Subchannel Selective Transmission (SST) and its subclauses as shown:***

**9.49 Subchannel Selective Transmission (SST)**

**9.49.1 SST Overview**

S1G STAs that are associated with an S1G AP transmit and receive on the channel or channels that are indicated by the AP as the enabled operating channels for the BSS.

An SST BSS is an S1G BSS for which the following conditions are satisfied:

1) The BSS operating channel width indicated in the Channel Width field of the S1G Operation Infor­mation element transmitted by the AP is less than or equal to 2 MHz.

2) The SST AP indicates that it enables SST operation by including the SST Operation element in the (Re-) Association Response frame sent to the non-AP STA.

An SST AP is an S1G AP with dot11SelectiveSubchannelTransmissionPermitted equal to true. During Aperiodic SST Operation, an SST AP indicates the set of enabled SST operating channels in an SST Operation element and the subset of SST channels that SST STAs are allowed to access during a (short) beacon interval in the SST element that is transmitted in the (short) beacon that initiates the (short) beacon interval. During Periodic SST Operation, an SST AP indicates the subset of SST channels that SST STAs are allowed to access during a (short) beacon interval in an RPS element that has a value of 1 in the Periodic RAW Indication subfield.

An SST STA is an S1G STA that is associated with an SST AP and that chooses a subset of the operating channels enabled for SST operation on which to operate in the BSS, when SST operation is activated by the AP as indicated in the most recently transmitted Subchannel Selective Transmission element.

SST STAs operating in an SST BSS are allowed to transmit on an SST channel during a (short) beacon interval only if the channel is permitted for SST use as indicated by the SST AP in an SST element included in the S1G Beacon frame that initiates the (short) beacon interval or as indicated by an RPS element in the case of Periodic SST Operation.

In an S1G BSS that is not an SST BSS, the enabled operating channels are indicated in the most recently received S1G Operation element transmitted by the AP.

**9.49.2 SST Basic Operation**

An SST AP that sets up an SST BSS shall include the SST Operation element in (Re-) Association Response frames sent during association. The S1G AP may include the SST Operation element in S1G Beacon frames. The SST AP indicates the set of enabled SST operating channels, the offset of the primary channel, and the channel width unit in the SST Operation element as described in 8.4.2.211 (SST Operation element). The set of enabled SST operating channels may include channels that are not in use by the BSS, as specified by the SST Enabled Channel bitmap of the element. The SST AP that sets up an SST BSS shall choose the subset of allowed SST operating channels from the subset of enabled SST operating channels indicated in the SST Operation element. The set of enabled SST operating channels indicated by the AP is not static.

At each T(S)BTT, an SST AP may send S1G Beacon frames on more than one channel from the set of enabled operating channels for the BSS either in parallel or in series or a combination of the two. A STA transmitting parallel S1G Beacons shall use either the value S1G\_DUP\_1M or the value S1G\_DUP\_2M for the TXVECTOR parameter FORMAT of the PHY-TXSTART.request for the transmission. An example of Beacons sent in parallel is when one Beacon frame(#5289) is transmitted with a value of S1G\_DUP\_2M for the TXVECTOR parameter FORMAT and a value of CBW8 for the TXVECTOR parameter CH\_ BANDWIDTH in a BSS with an operating width of 8 MHz. An example of Beacons sent in series is when several different Beacons are transmitted in sequence, each with a value of S1G for the TXVECTOR parameter FORMAT and a value of CBW2 for the TXVECTOR parameter CH\_ BANDWIDTH and each transmitted on a different 2 MHz subchannel in a BSS with an 8 MHz operating width. When Beacons are transmitted in series, all of the Beacons may be queued for transmission at T(S)BTT, but only one Beaconframe(#5289) is transmitted at a time. SIFS or later after any Beacon frame(#5289) in the series is transmitted, another Beacon frame(#5289) may be transmitted in the series, provided that normal medium access rules for the channel of transmission of the Beacon frame(#5289) have been satisfied.

NOTE—When a series of S1G Beacons is transmitted, the AP can use the Channel Activity Schedule of the SST element in those beacons to describe when UL transmissions are permitted by SST STAs in order to protect the beacon sequence and to avoid attempts to communicate with the AP during the beacon transmission sequence. RAW, CTS2SELF and other NAV-setting mechanisms can also be employed for this purpose.

An SST AP shall include the SST element in the S1G Beacon frame that immediately precedes a (short) beacon interval when it allows SST operation within that (short) beacon interval (see Figure 9-94 (Selective Subchannel Transmission channel transmission permission allocations from SST element)).



An SST AP may include an SST element in transmitted S1G Beacon frames. An SST AP includes an SST element with the DL Activity bit in the SST element set to 1 and estimated start times and SST channels for DL transmissions in the Channel Activity Schedule field to indicate the expected times for the transmission of DL frames. These frames can be used by SST STAs to estimate the channel parameters which can be used as input to an algorithm for the selection of an SST channel.

The AP may transmit sounding frames to SST STAs for the purpose of estimating channel parameters. The AP may transmit sounding frames for SST STA channel estimation either in parallel or in series or a combination of the two, where a parallel transmission by an S1G AP shall use either the value S1G\_DUP\_1M or the value S1G\_DUP\_2M for the TXVECTOR parameter FORMAT of the PHY-TXSTART.request for the transmission.

An S1G AP may include an SST element (see 8.4.2.198 (Subchannel Selective Transmission (SST) element)) in an S1G Beacon frame(#5289) to indicate on which channels an SST STA is allowed to transmit within the BSS or SST BSS.

An S1G AP may indicate on which SST channels it intends to transmit sounding and non-sounding frames following the transmission of an S1G Beacon frame by including a SST element in the S1G Beacon frame with a nonzero(#5403) value in at least one bit of the Channel Activity Bitmap subfield and a value of 1 in the corresponding DL Activity subfield. An SST STA may choose an SST channel for transmissions based on its analysis of the sounding signals and received transmissions.

In an SST BSS, an SST STA shall not transmit in a channel that is not the primary channel of the BSS if the corresponding bit of the SST Channel Activity Bitmap is 0 in the most recently received SST element from its associated AP. An SST STA shall not transmit using a channel width that is greater than the value of the SST Channel Unit indicated in the most recently received SST Operation element from its associated AP.

When no SST Operation element has been received by an SST STA from its associated AP, the STA shall not transmit a frame with a BSSID that is equal to the BSSID of the BSS with which the STA is associated, in a channel of operation that is not included in the channels of operation of the BSS.

If the frames that are transmitted by an S1G AP in response to an announcement of transmission activity within a SST element are sounding frames, the S1G AP shall use the same value for the TXPWR\_LEVEL parameter of the TXVECTOR for each of the sounding frame transmissions associated with the SST element announcement. An S1G AP should transmit SST sounding frames at times and on SST channels indicated for downlink activity in the Activity Start Time and Channel Activity Bitmap fields of the SST elements that it transmits.

The AP may signal the presence of a RAW for the purpose of SST sounding for a group of STAs using an SST sounding RAW as indicated within a transmitted RPS information element. Such an SST Sounding RAW may be scheduled for periodic or non-periodic operation. An additional RAW(s) may be scheduled as SST Report RAW(s) (see 8.4.2.188 (RPS element)) after the SST Sounding RAW for the transmission of S1G NDP CMAC frames (e.g., NDP PS-Poll frame(#5289)) by SST STAs on their selected channel(s) for the purpose of communicating a selected subchannel to the AP. The AP is not required to use a RAW for SST sounding.

In the SST Report RAW, the STA transmits a report frame to the AP not earlier than the start of its assigned RAW slot, followed by the AP's response for confirmation after SIFS.

When the AP uses a RAW for SST sounding, RAW Type is Sounding RAW, and the RAW Type Options subfield is equal to SST Sounding RAW in the RPS information element (See 8.4.2.188 (RPS element)) transmitted by the AP. The SST sounding sequence within the SST Sounding RAW comprises a series of S1G NDP CMAC frames (e.g., NDP CTS frames), each transmitted on one of the channels among those indicated by the Channel Indication field of the RAW, starting with lowest frequency channel and continuing in sequence with the next higher frequency channel if more than one channel is indicated. The RPS element for the SST sounding RAW specifies a start time, channel(s) and RAW duration for each RAW assignment. The AP shall not transmit any S1G NDP CMAC frame on a channel within an SST sounding RAW before the TxPIFS slot boundary as defined in 9.3.7 (DCF timing relations). If the AP does not observe an idle medium condition within one PIFS after switching to a channel, then the AP shall not transmit an NDP, but shall wait for the duration of an NDP before switching to the next channel. This deterministic channel switching allows listening SST STAs to predict the timing of the sounding transmission for each channel. An AP may schedule multiple SST sounding RAWs to increase the probability that a sounding frame is transmitted on each SST channel. The amount of time allocated in the Sounding RAW for the channel switch operations performed by the AP is implementation dependent, and is calculated at the non-AP STA by subtracting the value N \* (PIFS + NDPTxTime) from the total RAW duration and dividing the result by N-1, where N is the number of channels to be sounded.

When the AP uses a RAW for SST operation and the RAW is not a sounding RAW, then the RAW Type is Generic RAW and the Channel Indication Presence bit is set to 1 and the number of channels indicated in the Channel Indication in the RPS information element (See 8.4.2.188 (RPS element)) transmitted by the AP shall be one, unless there is only one STA assigned to each slot in the RAW defined by the RPS element. An AP shall not schedule any non-SST STA within a RAW that has a Channel Indication Presence bit equal to 1.

A local S1G Beacon frame(#5289) is one that was transmitted by the AP with which a STA is associated.

An SST STA may select one or more SST channels from the enabled SST operating channels as indicated in the SST Operation element transmitted by the SST AP with which it is associated. The SST STA may operate on those SST channels for the (short) beacon interval following a T(S)BTT if a local S1G Beaconframe(#5289) with an SST element indicating that a subset of the enabled SST channel(s) are allowed for SST operation has been received by the SST STA during that (short) beacon interval. The STA shall not transmit frames on the indicated allowed SST channels with a bandwidth that is greater than the Maximum Transmission Width specified in the SST element. If no local S1G Beacon frame(#5289) is received following a T(S)BTT, then no SST STA transmission is allowed during the (short) beacon interval that begins at that T(S)BTT except on the primary channel of the BSS. If an SST STA receives a local S1G Beacon frame(#5289) which contains no SST element, the SST STA may transmit on the primary channel of the BSS a PPDU of width up to the BSS bandwidth indicated in the S1G Beacon frame during the (short) beacon interval that immediately follows the reception of the S1G Beacon frame.

An SST STA that has selected an SST operating channel that is not the primary channel for the BSS shall operate on the selected channel as though the channel is the primary channel of the BSS, but only at the times allowed for operation on the selected channel as indicated in this subclause.

An SST STA which selected its best SST operating channel(s) may report its selection to the SST AP by sending an NDP PS-Poll frame on the primary channel of the BSS, including the selected SST channel offset in the UDI field. The transmission of any frame on an allowed subchannel by an SST STA is an implicit indication to the AP as to the subchannel selection made by the SST STA. An SST STA may queue for transmission, a QoS NULL frame addressed to the AP for this purpose. To avoid ambiguity in which subchannel has been selected by the STA as its primary channel, the STA can send the frame using the minimum width channel for the band of operation on the selected primary channel.

An SST STA that has selected a subchannel for operation should operate on that subchannel during times indicated for permitted downlink and uplink operation according to the DL Activity and UL Activity fields and the Activity Start Time field in the SST element. An AP should transmit frames to SST STA on their selected subchannels.

An SST STA shall not transmit to the AP on an SST operating channel that is not indicated as allowed by the AP in the SST element. The set of allowed SST channels indicated by the AP in the SST element (#3134) is dynamic and can change every (short) beacon interval.

**9.49.2 Periodic SST Operation**

During Aperiodic SST Operation, an SST AP signals explicit permission of SST STA transmissionsduring each single (short) beacon interval in which SST operation is permitted by transmitting the SST Operation element. During Periodic SST Operation, an SST AP signals permission of SST STA transmissions over multiple (short) beacon intervals through the transmission of the RPS element with the Channel Indication Presence bit equal to 1 and the Periodic RAW Indication bit equal to 1.

Aperiodic SST Operation shall follow the procedure in 9.49 (Subchannel Selective Transmission (SST)).

Periodic SST Operation shall follow the procedure in 9.49 (Subchannel Selective Transmission (SST)) with the additional requirement that the SST AP shall transmit at least one RPS element with the Channel Indication Presence bit set to 1 and the Periodic RAW Indication bit set to 1 preceding the first (short) beacon interval during which SST operation is permitted. The periodicity, validity, and start offset of the Periodic SST Operation are indicated in the Periodic Operation Parameters subfield of the RAW Assignment field of RPS element. When the RPS element is used to indicate a periodic SST sounding schedule, the RAW Type subfield of the RPS element is set to Sounding RAW and the RAW Type Options subfield of the RPS element is set to SST Sounding RAW.

**References:**