IEEE P802.11
Wireless LANs

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| LB 266 Resolution for misc CIDs related to r-TWT |
| Date: July 7, 2022 |
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 Abstract

This submission proposes resolutions for following 31 CIDs received for TGbe LB266:

10191, 10192, 11826, 12767, 12768(?), 12456,

12276, 12394

10467, 10468, 10687, 13243

13483, 13012, 10894, 10892, 13300,

10893, 13023, 11780, 11616, 13018,

10465, 10857, 11110, 11585, 11618,

13101, 13235, 12402, 11023

**Revisions:**

* Rev 0: Initial version of the document.

***TGbe editor: The baseline for this document is 11be D2.0***

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

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

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

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| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 10191 | John Wullert | 4.5.6.3 | 60.43 | Description of latency sensitive traffic as showing "periodic pattern with burst arrival of packets" seems contradictory. | Rephrase as "Such traffic typically shows periodic packet arrival, potentially punctuated with temporal packet bursts. | **Revised**The “bursty” part refers to the traffic pattern within each interval.**TGbe editor: please make the change indicated in this doc 11-22/xxxx tagged with 10191.** |
| 10192 | John Wullert | 4.5.6.3 | 60.45 | Sentence suggests that there are more mechanisms than rTWT in the specification that provide predictable latency. | Sentence suggests that there are more mechanisms than rTWT in the specification that provide predictable latency. | **Reject**The sentence “such as …” is intended to give an example which is what’s developed specifically for this purpose in 11be, and doesn’t int---- END to provide an exhaustive list., esp. doesn’t want to preclude any future invention. |
| 11826 | Alfred Asterrjadhi | 4.5.6.3 | 60.42 | Please replace "average and the worst case" with "agerage and the worst case latency". | As in comment. | **Revised****TGbe editor: please make the change indicated in this doc 11-22/xxxx tagged with 11826.** |
| 12767 | Romain Guignard | 4.5.6.3 | 60.37 | As the latency and the reliability are not well-defined, the mechanism defined to improve the latency can be used for a large category of traffic that may lead to drop its overall efficiency | Please, define different levels of requirement for the latency and the reliability otherwise we cannot know exactly what is supported and what is characterised as low latency traffic (Low latency is for traffic with a requirement below 1ms or 10ms or 100 ms) | **Rejected**The latency and reliability are well defined based on specific context, in many literatures and practice. The exact range or level of latency support (average/jitter etc.) is subject to the realization of a mechanism(e.g. r-TWT schedule), implementation, and network/channel conditions etc., and is out of the scope of IEEE 802.11 spec. |
| 12768 | Romain Guignard | 4.5.6.3 | 60.37 | The support for predictable latency is based on statistical approach (QoS characteristics) which is well adapted for periodic traffic. The standard should also consider the aperiodic low latency traffic (control command, almost expired time-to-live packets for high reliability traffic). | Please consider signalling such as BSR to inform AP about instantaneous low latency needs. | **Reject**Theoretically or practically, QoS IE (per 9.4.2.316) can be programmed to indicate ‘aperiodic’ traffic if you specify, e.g., 1usec as minimum service interval. Don’t see it’s necessary to signal with a new BSR field/handshake.  |
| 12456 | Rajat Pushkarna | 3.2 | 53.51 | What is the definition of latency-sensitive traffic? Latency sensitivity of traffic can be application-specific. | Define what is the minimum latency required that is supported by EHT STAs. | **Rejected**The description of latency sensitive traffic was in 4.5.6.3. The exact minimum latency in its average and worst case can be implementation and network/channel conditions dependent, and is out of scope of the 802.11 spec.  |

**4.5.6.3 Support for predictable latency**

Traffic originating from many real time applications has stringent requirements in terms of latency and its jitter along with certain reliability constraints. Such traffic is referred to as latency sensitive traffic. Latency sensitive traffic requires packets to be delivered with predictable latency in terms of both its average and (#11826) the worst case values ~~its worst cases~~ over the wireless. Such traffic typically shows periodic patterns with burst arrival of packets (#10191) in each interval.

This standard defines mechanism(s) such as restricted TWT (35.9 (Restricted TWT (r-TWT))) to enable the BSS to use enhanced medium access protection and resource reservation to provide predictable latency with higher reliability for latency sensitive traffic over the wireless link.

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| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 10456 | ~~Yonggang Fang~~ | ~~9.4.2.199~~ | ~~0.00~~ | ~~Please clarify whether priority access (e.g., EPCS) is allowed to share r-TWT SP for EDCA based UL transmission? If allowed, please specify rules for an STA affiliated with EPCS priority access enabled non-AP MLD to share with non priority access devices in r-TWT SP. If not, please specify a rule as well.~~ | ~~in the comment~~ | **~~Rejected~~**~~As specified in 35.9.5 (Traffic delivery), within r-TWT SPs, traffic identified by r-TWT TIDs are \*prioritized\* by the member STAs (AP and non-AP STAs that are members) but doesn’t preclude other STAs to cont---- END the medium, nor prohibit member STAs to transmit traffic of other TIDs (but subject to the prioritization rule.) It’s subject to each non-AP STA/MLDs to utilize these two features in sensible/practice ways, and how exactly is out of the scope of 802.11 spec.~~ |
| 10464 | ~~Yongfang Fang~~ | ~~35.9.2.2.2~~ | ~~0.00~~ | ~~Please clarify whether it allows a SP to share with a priority traffic (e.g., EPCS) in in the r-TWT setup. If it is not allowed, how to separate a priority access from non-priority access in the same SP? If it is allowed, please specify channel access rule for prioirty access in the shared SP.~~ | ~~In the comment~~ | **~~Rejected~~**~~It is possible the EPCS traffic also gets delivered during the r-TWT SP, e.g. when the latency sensitive traffic has completed, and also that the medium access during r-TWT SP is EDCA/MU-EDCA based. However, the comment didn’t raise any specific issue to make it necessary to define additional rules or procedures, nor any issue is observed.~~ |
| 12276 | Rajat Pushkama | 35.9.1 | 510.56 | What about other high priority traffic, e.g. EPCS traffic, shouldn't such traffic also benefit from the r-TWT services? | Include other high priority traffic, e.g. EPCS traffic as other potential traffics that could use the r-TWT mechanism. | **Reject** |
| 12394 | Rojan Chitrakar | 35.9.1 | 510.56 | What about other high priority traffic, e.g. EPCS traffic, shouldn't such traffic also benefit from the r-TWT services? | Include other high priority traffic, e.g. EPCS traffic as other potential traffics that could use the r-TWT mechanism. | **Reject** |
| 10467 | Yonggang Fang | 35.9.5 | 512.46 | Please clarify the sentence "An r-TWT scheduling AP or a member r-TWT scheduled STA that has initiated or participated in a frame exchange during a restricted TWT SP shall ensure QoS Data frames of r-TWT TID(s) to be first delivered during the r-TWT SPs":1) If rTWT SP is allocated to both DL and UL rTWT TIDs, which one should be first transmitted, DL or UL?2) if two or more rTWT TIDs are allocated to the same SP, which TID of traffic should be first to send? | please clarify in the spec | **Rejected**The current text in 35.9.5 allows the flexibility – for (1) it’s upto AP’s schedule in trigger-enabled SP; or it depends on who wins the medium access first; for (2) same answer to the above.There is no need to add extra rules as these are baseline behavior (EDCA/MU-EDCA) and implementation choice. |
| 10468 | Yonggang Fang | 35.9.5 | 512.49 | Please clarify the sentence: "In a trig-ger-enabled restricted TWT SP, when scheduling the transmission of Trigger frames, the r-TWT scheduling AP shall first trigger member r-TWT scheduled STAs to facilitate them to first deliver their QoS Data frames of r-TWT UL TID(s), if any."How to setup rTWT SP with DL/UL rTWT TID bitmaps for a TID.1) is the bit of TID in DL rTWT TID bitmap set to 0 while the corresponding bit in UL TID bitmap set to 1? After triggered rTWT members complete UL transmission, can other rTWT members of same TID perform EDCA in the remaining rTWT SP?2) If the bit of TID in DL rTWT TID bitmap and UL rTWT TID bitmap are set to 1, should other member STAs and AP cont---- END the media for transmitting QoS data frame in the remaining rTWT SP after triggered rTWT members complete UL transmission? | please clarify in the spec | **Rejected**Re. the first question (how to setup …), text in 35.9.2.2 (The setup procedure) P511L50-54 explained that the r-TWT TIDs are the TIDs indicated during the r-TWT setup procedure.Re. Q (1) the prioritized traffic is identified by the (r-TWT membership, r-TWT TIDs). Non-r-TWT member STAs can access the channel per EDCA/MU-EDCA rules as in the baseline.Re. Q (2) Yes. But note that AP shall prioritize traffic of r-TWT TIDs of the r-TWT member STAs.These are specified in 35.9.5 and no need of additional text.  |
| 10687 | Liangxiao Xin | 35.9.5 | 512.44 | Can a member STA transmit the traffic of non-R-TWT TIDs outside its R-TWT SPs? Can a member STA transmit the traffic of R-TWT TIDs outside its R-TWT SPs? | a member STA shall be able to transmit non R-TWT TIDs out-side its R-TWT SPs. | **Rejected**On this regard, r-TWT follows the baseline TWT rule:11axD8.0, P423L52-55 --“*A TWT scheduling AP may transmit to a TWT scheduled STA that is in active mode at any time (see 11.2.3.2 (Non-AP STA power management modes)). A TWT scheduling AP may transmit to a TWT scheduled STA that is in PS mode and awake outside of a TWT SP following the rules in 11.2.3.6 (AP operation).”* 11axD8.0, P425L8-12:“*A TWT scheduled STA should not transmit frames to the TWT scheduling AP outside of broadcast TWT SPs and should not transmit frames that are not contained within HE TB PPDUs to the TWT scheduling AP within trigger-enabled broadcast TWT SPs, except that the STA can transmit frames within negotiated individual TWT SPs as defined in 26.8.2 (Individual TWT agreements).*”r-TWT (see 35.9.5) didn’t add additional rules w.r.t what the comment says. The answer to the questions can be seen from the above text. |
| 13243 | Binita Gupta | 35.9.5 | 512.47 | The first requirement applies for both trigger enabled and non-trigger enabled rTWT SPs. Modify text to clarify this. | Modify first req as follows "An r-TWT scheduling AP or a member r-TWT scheduled STA that has initiated or participated in a frame exchange during a trigger enabled or a non-trigger enabled restricted TWT SP shall ensure QoS Data frames of r-TWT TID(s) to be first deliveredduring the r-TWT SP." | **Rejected**The first sentence applies to all types of SPs (trigger-enabled or not) and hence there is no need to enumerate all possible variants. |

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| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 13483 | Liwen Chu | 9.4.2.313.2 | 231.06 | it seems to me that dot11RestrictedTWTOptionImplemented being true means that the STA supports the r-TWT operation | Change to "Set to 1 if the STA supports the r-TWT operation (see 35.9 (Restricted TWT (r-TWT)))." | **Accepted** |
| 13012 | Chunyu Hu | 35.9 | 510.56 | Some text still use “restricted TWT” in this subclause. | Change “restricted TWT” to r-TWT in applicable places. | **Revised**Agree with commenter. P53L50 introduced the r-TWT abbrev in def. Fix in 9.4.2.199 and 35.9. Changed 2+4 places in total.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13012.** |
| 10894 | Charlie Petterson | 35.9 | 512.15 | There is inconsistent use of "r-TWT" and "restricted TWT" throughout this sub-clause. | Change to "r-TWT". | **Revised**Same resolution as 13012.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 10894.** |
| 10892 | Charlie Petterson | 35.9 | 512.25 | There is inconsistent use of "an r-TWT" and "a r-TWT" thorughout this subclause. | Change to "an r-TWT". | **Revised**Fixed 2 places: one in 9.4.2.199, and one in 35.9.4.2**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 10892.** |
| 13300 | Binita Gupta | 35.9.4.2 | 512..25 | Change to “an r-TWT SP” | As in comment | **Revised**Same resolution as 10892.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13300.** |
| 10893 | Charlie Petterson | 35.9 | 511.56 | There is inconsistent use of "service period" and "SP" throughout this subclause | Change to "SP". Note that there are both headline and text inconsistencies. | **Revised**Changed 6 places in total.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 10893.** |
| 13023 | Chunyu Hu | 35.9.3 | 512.56 | Use the definition "r-TWT SP" that has been defined instead of "r-TWT service periods". | Change service periods to SPs in the title and other applicable places in subsection 35.9. | **Revised**Same resolution as CID 10893.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13023.** |
| 11780 | Osama Aboulmagd | 35.9.1 | 510.57 | What does the term "enhanced medium access protection" refer to? Enhanced relative to what? | Clarify | **Reject** – the ‘enhanced’ refers to the additional rules that are specifically introduced for r-TWT, e.g. the channel access rules described in 35.9.4 (Channel access rules for r-TWT SPs). |
| 11616 | Lei Wang | 35.9.1 | 511.01 | Searched the entire 11be/D2.0, could not find clear descriptions/defitions about the r-TWT membership, e.g., what's an r-TWT schedule? What is an r-TWT membership? Is an r-TWT membership per link or per EHT STA for an r-TWT schedule? How the membership is managed, by EHT AP and/or EHT STA? | Please provide clear defintions and descriptions about r-TWT membership, e.g., asnwering the questions as listed in this comment. | **Rejected**Answer the questions below but no change in text is needed.r-TWT membership inherits the broadcast TWT membership term. Please see the baseline doc in 802.11axD8.0, or 11meD1.x.r-TWT schedule also inherits the TWT schedule in the baseline.The membership and schedule are both per link based. E.g. the baseline (11axD8.0 P420L1-4) states: “*Each broadcast TWT is uniquely identified by the <broadcast TWT ID, MAC address> tuple, where the broadcast TWT ID is the value of the Broadcast TWT ID subfield and is greater than 0 and the MAC address is the address of the TWT scheduling AP.”* This still applies to TWT in 11be and also r-TWT. |
| 13018 | Chunyu Hu | 35.9.2 | 511.09 | For r-TWT schedule setup, since rTWT is based on broadcast TWT, it should use the same term: membership. | Use "membership" instead of "agreement" in the title and elsewhere applicable. | **Revised** – agree with commenter and identified ~5 places to fix.**TGbe editor: please replace “agreement” with “membership” and “agreements” with “memberships” in subclause 35.9.** |
| 10465 | Yongfang Fang | 35.9.3 | 511.60 | It is not clear about "modified broadcast TWT element". Does it mean "r-TWT" ? | Please clarify in the spec | **Revised** – agree with commenter in principle and adopt same solution as for CID 13101.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13101.** |
| 10857 | Jinsoo Choi | 35.9.3 | 511.60 | The modified broadcast TWT element is too broad term to identify what is specifically amended or defined for announcing the r-TWT SP schedule information in the broadcast TWT element in 26.8.3 (Broadcast TWT operation). | Need to specify what is defined for the r-TWT SP schedule information in the broadcast TWT element. | **Revised** – agree with commenter in principle and adopt same solution as for CID 13101.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13101.** |
| 11110 | Brian Hart | 35.9.3 | 511.60 | "modified broadcast TWT" is vague, and the term does not appear elsewhere in the std or 11be amendment. | Clarify what is modified and how. Presumably it is modified by the inclusion of certain r-TWT info but does this just mean Broadcast TWT Recommendation field value is set to to 4 (and everything that flows from that) or is something more implied? | **Revised** – agree with commenter in principle and adopt same solution as for CID 13101.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13101.** |
| 11585 | Xiaofei Wang | 35.9.3 | 511.60 | why is broadcast TWT element "modified"? | remove "modified" | **Revised** – agree with commenter in principle and adopt same solution as for CID 13101.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13101.** |
| 11618 | Lei Wang | 35.9.3 | 511.60 | The word "modified" is not needed, as it is clearly specified by "which are specified in 26.8.3 (Broadcast TWT operation)". In addition, the word "modified" actually introduce uncessary questions, e.g., what is modified? | Remove the word "modified" in line 60 pate 511. | **Revised** – agree with commenter in principle and adopt same solution as for CID 13101.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13101.** |
| 13101 | Chittabrata Ghosh | 35.9.3 | 511.59 | "modified TWT element" is not clear, should refer to subclause and identify what modification was made to announce r-TWT schedules | Replace the first sentence as "If there is any r-TWT agreement setup, the r-TWT scheduling AP shall announce the r-TWT schedule information by including restricted TWT parameter set field(s) in the broadcast TWT element as specified in 9.4.2.199 (TWT element), contained in transmitted Management frames, which are specified in 26.8.3 (Broadcast TWT operation)" | **Revised** – agree with commenter in principle.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13101.** |
| 13235 | Binita Gupta | 35.9.3 | 511.60 | In the text "If there is any r-TWT agreement set up, the EHT AP shall announce the r-TWT SP schedule information in the modified broadcast TWT element contained in transmitted Management frames, which are specified in 26.8.3 (Broadcast TWT operation)." it is not clear what is modified broadcast TWT element. Add reference 9.4.2.199 for the modified broadcast TWT element indicating rTWT related updates. | As in comment | **Revised** – agree with commenter in principle and adopt same solution as for CID 13101.**TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 13101.** |
| 12402 | Rojan Chitrakar | 35.9.3 | 511.63 | Since TWT memberships are SP based shouldn't "r-TWT schedule" be "r-TWT SP schedule" instead, as in the previous paragraph (r-TWT SP schedule information)? | Rename "r-TWT schedule" to "r-TWT SP schedule". | **Rejected** – adding SP to say “r-TWT SP schedule” vs “r-TWT schedule” add more information and the latter is concise/sufficient. The baseline as in 802.11axD8.0 also uses “TWT schedule” (59+28 instances) instead of having ‘SP’. |
| 11023 | Hanqing Lou | 35.9..3 | 512.03 | "A STA" should be "A non-AP STA" | See comment | **Revised****TGbe editor: please make the change indicated in this doc 11-22/1098 tagged with 11023.** |

**4.5.6.3 Support for predictable latency**

***TGbe editor: please revise the second paragraph as follows:***

This standard defines mechanism(s) such as (#13012,10894)r-TWT (35.9 (Restricted TWT (r-TWT))) to enable the BSS to use enhanced medium access protection and resource reservation to provide predictable latency with higher reliability for latency sensitive traffic over the wireless link.

***---- END of editing instruction ----------------------***

***TGbe editor: please revise Table 9-339 at D2.0 P206 as follows:***

1. **Table 9-339—Broadcast TWT Recommendation field for a broadcast TWT element**

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| **Broadcast TWT Recommendation field value** | **Description when transmitted in a broadcast TWT element** |
| … | … |
| 4 | The corresponding broadcast TWT SP is referred to as (#10892,13300)an r-TWT SP.During a (#13012,10894)r-TWT SP, the AP and member r-TWT scheduled STAs prioritize their transmission of QoS Data frames that are latency sensitive traffic (see 35.9 (Restricted TWT (r-TWT))). |
| ~~4-7~~5–7 | Reserved |

***---- END of editing instruction ----------------------***

**35.9 Restricted TWT (r-TWT)**

**35.9.1 General**

***TGbe editor: please revise the last paragraph (A non-AP EHT STA establishes …) as follows:***

A non-AP EHT STA establishes membership for one or more r-TWT schedules with its associated EHT AP by following the rules defined in 26.8.3 (Broadcast TWT operation) with the additional rules defined in 35.9.2 (r-TWT agreement setup). An EHT AP that has dot11RestrictedTWTOptionImplemented equal to true may announce one or more r-TWT SPs as described in 35.9.3 (r-TWT (#10893,13023)SPs announcement). EHT STAs that support r-TWT operation follow the rules as defined in 26.8.3 (Broadcast TWT operation) and the additional rules and restrictions that are defined in the subclauses below.

***---- END of editing instruction ----------------------***

**35.9.3 (#10893,13023)R-TWT SPs announcement**

***TGbe editor: please revise the first paragraph as follows:***

If there is any r-TWT agreement set up, the EHT AP shall announce (#13101)the r-TWT schedule information by including r-TWT parameter set field(s) in the broadcast TWT element as specified in 9.4.2.199 (TWT element), contained in transmitted Management frames, which are specified in 26.8.3 (Broadcast TWT operation).

An r-TWT scheduling AP, while advertising an r-TWT schedule, shall indicate whether or not the schedule is available for accommodating any new membership. If the Restricted TWT Schedule Full subfield in the Broadcast TWT Info subfield in a Restricted TWT Parameter Set field is set to 1, it indicates that the corresponding r-TWT schedule is not available for accommodating any new membership; otherwise, it is available for new membership. A (#11023)non-AP STA should not request to establish membership in an r-TWT schedule advertised by the r-TWT scheduling AP with Restricted TWT Schedule Full subfield set to 1.

***---- END of editing instruction ----------------------***

***TGbe editor: please revise the title as follows:***

**35.9.4 Channel access rules for r-TWT (#10893,13023)SPs**

**35.9.4.1 TXOP rules for r-TWT SPs**

***TGbe editor: please revise the first paragraph as follows:***

A non-AP EHT STA with dot11RestrictedTWTOptionImplemented set to true as a TXOP holder shall ensure the TXOP ends before the start time of any r-TWT SPs advertised by the associated AP. Before starting transmission of any MPDU, a non-AP EHT STA with dot11RestrictedTWTOptionImplemented set to true that is not a TXOP responder and not a member of the upcoming (#13012,10894,10893)r-TWT SP shall check if there is enough time for the frame exchange to complete prior to the start of the (#13012,10894,10893)r-TWT SP and, if there is not enough time then the STA shall defer transmission by selecting a random backoff count using the present CW (without advancing to the next value in the series). The QSRC[AC] for the MSDU or A-MSDU are not affected.

***---- END of editing instruction ----------------------***

***TGbe editor: please revise the title and the first paragraph as follows:***

**35.9.4.2 Quieting STAs during r-TWT (#10893,13023)SPs**

An r-TWT scheduling AP may schedule at most one quiet interval that overlaps with (#10892,13300)an r-TWT SP. Each such quiet interval, referred to as an overlapping quiet interval in this subclause, if scheduled, shall have a duration of 1 TU, and shall start at the same time as the corresponding r-TWT SP.

***---- END of editing instruction ----------------------***

**35.9.5 Traffic delivery**

***TGbe editor: please revise the first paragraph as follows:***

An r-TWT scheduling AP or a member r-TWT scheduled STA that has initiated or participated in a frame exchange during (#13012,10894)an r-TWT SP shall ensure QoS Data frames of r-TWT TID(s) to be first delivered during the r-TWT SPs. In a trigger-enabled (#13012,10894)r-TWT SP, when scheduling the transmission of Trigger frames, the r-TWT scheduling AP shall first trigger member r-TWT scheduled STAs to facilitate them to first deliver their QoS Data frames of r-TWT UL TID(s), if any.

***---- END of editing instruction ----------------------***