**IEEE P802.11
Wireless LANs**

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| **CC36 Comment Resolution for Some CIDs** **for 35.7 and 35.7.1 on Restricted TWT General and Its Support** |
| **Date:** 2022-03-27 |
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**Abstract**

This submission proposes resolutions for the following CIDs (60) for TGbe CC36:

4154, 4311, 4489, 4588, 4662, 4708, 4712, 4713, 4716, 4718,

4720, 4721, 4764, 4765, 4766, 4768, 4769, 4770, 4771, 4773,

4774, 4776, 4777, 4934, 4936, 4938, 5031, 5033, 5082, 5520,

5771, 5874, 5875, 5937, 6062, 6334, 6385, 6386, 6415, 6417,

6418, 6419, 6420, 6421, 6476, 6478, 6676, 6866, 6897, 6949,

7427, 7428, 7429, 7430, 7620, 7632, 7845, 7859, 8052, 8063

Revisions:

* Rev 0: Initial version of the document
* Rev 1: incorporate some editorial changes from Abdel in 35.9.1, revised CR for a few CIDs on MLO channel access part and added a few related CIDs.
* Rev 2: fixed a CID number (6422->6420)
* Rev 4: add resolution for CID 4712, 4713, 4769, 6062
* Rev 5: revised resolution to 1st paragraph that seem to have most support and left rest text out.

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.***

***TGbe editor: The baseline for this document is {11be D1.5 + 11-22/326r5} and 11meD1.0.***

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| **CID** | **Commenter** | **Clause** | **Page/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4154 | Alfred Asterjadhi | 35.6 | 298.20 | I think 35.6.2 is a better reference here, as it covers the announcement of these schedules as well. Hence replace the reference with 25.6.2 and remove "if the EHT AP has announced restricted TWT service periods. | As in comment. | **Revised.** Agree in principle. Change the reference in relevant place(s) to be general for the rtwt operation instead of a specific subclause.**TGbe editor please implement changes as shown in this doc tagged by 4154.** |
| 4708 | Chien-Fang Hsu | 35.6.1 | 298.06 | It is not clear if other TWT implementation is required or not, such as dot11TWTOptionActivated and dot11TWTGroupingSupport. | Clarify if supporting rTWT, other features are required or not. | **Revised.** Agree in principle. **TGbe editor please implement changes as shown in this doc tagged by 4708.** |
| 6334 | Ming Gan | 35.6.1 | 298.20 | some condition is missing, for example, the EHT STA that supports rTWT should be a member of this broadcast TWT | as in the comment | **Revised.** Agree in principle. **TGbe editor please implement changes as shown in this doc tagged by 6334.** |

**35.9.1 General**

TGbe editor: please revise the second + third paragraph as follows:

(#7082) An EHT STA that supports restricted TWT operation has dot11RestrictedTWTOptionImplemented set to true, otherwise, the EHT STA has dot11RestrictedTWTOptionImplemented set to false. ~~A~~n EHT STA with dot11RestrictedTWTOptionImplemented equal to true shall set the Restricted TWT Support subfield in transmitted EHT Capabilities elements to 1 (#4708, #6334)and shall set the Broadcast TWT Support subfield to 1 in transmitted HE Capabilities element; otherwise, the EHT STA shall set the Restricted TWT Support subfield in transmitted EHT Capabilities elements to 0.

A non-AP EHT STA establishes membership for one or more restricted 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 restricted TWT service periods as described in 35.9.3 (r-TWT service periods announcement). (#4154)EHT STAs that support restricted TWT operation follow the rules as defined in 26.8.3 (Broadcast TWT operation) and the additional rules and restrictions that are defined in ~~35.9.4 (Channel access rules for r- TWT service periods) if the EHT AP has announced r-TWT SPs.~~ the subclauses below.

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| **CID** | **Commenter** | **Clause** | **Page/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4311 | Alfred Asterjadhi | 35.6.1 | 0.00 | Normative behavior for SST is missing. Define rules by mainly pointing out to baseline SST (from 11ax). | As in comment. | **Rejected** – SST is defined for iTWT. Didn’t see any specific reasoning or proposal to extend it to bTWT/rTWT at this point. |
| 4489 | Arik Klein | 35.6 | 297.57 | Along section 35.6 there restricted TWT and Restricted TWT are used interchangeably..... | Please align it to either restricted TWT or Restricted TWT, but not both. | **Revised.** The editor has done necessary editing. Don't observe any such instances in the latest draft D1.5.**TGbe editor: no change needed.** |
| 4764 | Chunyu Hu | 5.2 | 311.01 | 11be defines rTWT as the low latency QoS delivery mechanism, however it lacks of service interface to the upper layer. Note: page/subclause are based on P802.11mdD5.0 | Consider adding necessary parameter(s) in service primitive for low latency service signaling. | **Rejected** – inspected subclause 6.3 and observed that rTWT as a variant of bTWT is covered under TWT part. See no additional changes are needed per D1.5. |
| 5937 | Li-Hsiang Sun | 36.6.1 | 298.07 | Did not find "Restricted TWT Support subfield" | add the filed in EHT capabilities element | **Revised** – this subfield has been added to a later draft.**TGbe editor: no change is needed.** |
| 5031 | Evgeny Khorov | 36.4.2 | 298.58 | The duration of Quite Interval is fixed to 1 TU | Make the duration flexible and correspond to the TWT SP | **Rejected** – this is similar to the proposal made in CID 4939 (discussed in doc 11-21/1930r6) and was rejected with the reason summarized below: quiet interval is intended to extend the similar r-TWT SP start time protection support from legacy STA as well. To that end, a minimum duration of 1 TU is sufficient. |
| 5033 | Evgeny Khorov | 35 | 0.00 | Add the ability to distiguish RA RU for RTA | As in comment | **Rejected** – the comment fails to identify a technical issue and is lack of context and details to come up with necessary changes satisfying the comment. |
| 7430 | SunHee Baek | 35.6.4.1 | 298.45 | Any EHT STAs schduled to a rTWT SP may be affected by OBSS (e.g., OBSS NAV), which may not guerantee low latency requirements. In this case, we need to handle the case, e.g., althrough OBSS NAV is set, it may ignore/reset it by monitoring transmitted frames of OBSS STAs (e.g., More Data field) or including CF-end frames if OBSS STA intends to stop TXOP by the corresponding rTWT SP detection | As in comment | **Rejected** – Agreed with the intention however the comment fails to identify any specific scenarios that require new rules. The baseline, e.g. 26.2.2-5 already covers the OBSS NAV resetting rule (e.g. the CF-end cancelling a TXOP). Even without any restricted SP, a STA has incentive to reset/adjust any NAV to maximize its transmission opportunity allowed by the common rules.  |
| 7620 | Tomoko Adachi |   | 0.00 | The MAC needs to be able to measure the delay of data delivery, from the time when data is passed from the upper layer till successful delivery at the peer MAC. This is fundamental to see if there is improvement in delay. | As in comment. | **Rejected** – the comment fails to identify a problem. Note that the baseline defines some measurement reports, see 4.3.11.7 for example. |
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| 4777 | Chunyu Hu | 35.6 | 298.58 | TDLS link can setup TWT using individual TWT. rTWT is introduced based on bTWT. Should we consider extending the setup of rTWT over TDLS as well? Given that TID is used to identify latency sensitive traffic, even it's over a direct/TDLS link, using rTWT allows the participating STAs to prioritize traffic of certain TIDs over others. | Please consider necessary changes to add the support. Can bring in a proposal. | **Rejected** – TWT can be setup over TDLS links per baseline. The comment fails to identify exact issues/gaps. |
| 6897 | Rubayet Shafin | 35.6 | 297.58 | Restricted TWT would be an important power saving mechanism for TDLS peer STAs to communicate latency-sensitive traffic over the TDLS direct link. However, Broadcast TWT operation, which is the basis of restricted TWT operation, is not defined for TDLS peer STAs as a power saving mechanism (though individual TWT agreement can be established for the TDLS direct link). | Broadcast TWT operation needs to be defined in order to enable restricted TWT schedule for peer-to-peer links. | **Rejected** – The discussion/proposal in doc 11-21/1224 addresses this request, however, the group didn’t reach consensus.TWT can be setup over TDLS per baseline. Additional gap can be raised in next run. |
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| 4712 | Chittabrata Ghosh | 35.6.4 | 298.42 | In ML concept, how do we consider a scenario where a (NSTR or eMLSR) STA on one link approaches a scheduled r-TWT SP start time, while it gains channel access on another linkExample: STA 1 on link 1 has an r-TWT SP start time in 0.5ms, while STA 2 gains channel access on link 2 and starts transmitting dataDoes the STA prioritize Tx on link 2 and disregards waking up at beginning of r-TWT SP in link 1? | Please add specific behavior to consider the scenario | **Revised****Agree in principle.****TGbe editor, please implement changes as shown in this doc tagged by 4712** |
| 4713 | Chittabrata Ghosh | 35.3.14.3 | 275.28 | A similar rule as in the quoted text "An AP MLD should not transmit a frame that solicits an immediate response to a STA that is affiliated with a non-AP MLD on a link that is a member of one or more NSTR link pairs for that non-AP MLD, if the immediate response is expected to overlap in time with group addressed MPDUs scheduled in another link of any of those NSTR link pairs and the non-AP MLD is expected to be receiving those group addressed MPDUs."is needed for an EHT STA that is participating in an r-TWT SP in one link, should not be scheduled an RU/M-RU in a TF by an EHT AP on another link that is a member of one or more NSTR link pairs. | Please add specific behavior to consider the scenario in this subclause | **Revised****Agree in principle.****TGbe editor, please implement changes as shown in this doc tagged by 4713.** |
| 4769 | Chunyu Hu | 35.6 | 298.58 | While rTWT is a feature that can work with or without MLO MAC operation, there are some additional rules we should consider in multi-link operation. Consider adding a subclause in 35.7 to discuss MLO specific rules. Alternatively, for each aspect of rTWT, if there is anything particular to MLO, add context in corresponding subclause. | As commented. | **Revised****Agree in principle.****TGbe editor, please implement changes as shown in this doc tagged by 4769** |
| 6062 | Liwen Chu | 35.6 | 297.58 | the restricted TWT under MLD should be added, e.g. restricted TWT with NSTR MLD, eMLSR/eMLMR MLD. The issue of restricted TWT with such MLDs is that the other links' TXOP will have influence to the frame exchange in the retrixted TWT of a link. | Change the text according to the comment. | **Revised****Agree in principle.****TGbe editor, please implement changes as shown in this doc tagged by 6062** |
| ~~6420~~ | Muhammad Kumail Haider | 35.3.14.3 | 274.60 | The behavior of an NSTR STA and its associated AP on a link which is NSTR with another link on which the STA has an r-TWT agreement needs to be defined. This behavior should encompass r-TWT SP start boundary and transmissions of NSTR STA within the r-TWT SP. | Define channel access rules for NSTR non-AP STA as TXOP holder and responder on one link which is NSTR with another link on which an r-TWT SP occurs of which the non-AP STA is a member. The defined behavior should encompass r-TWT SP boundary rules and prioritize latency sensitive traffic delivery on the first link during r-TWT SP. | **Rejected**/revised?? – depend on the outcome of CID 6422. |
| ~~6421~~ | Muhammad Kumail Haider | 35.3.15 | 281.17 | The behavior of a non-AP STA in EMLSR mode and its associated AP when there is an r-TWT agreement on one or more enabled links needs to be defined. The rules should ensure the EMLSR STA ends its TX/RX before the r-TWT SP start boundary. | Define channel access rules for EMLSR non-AP STA as TXOP holder and responder to ensure any TXOP ends before r-TWT SP boundary on any link and latency sensitive traffic delivery is prioritized during the r-TWT SP. | **Rejected**/revised?? – depend on the outcome of CID 6422. |

**Discussion**:

Doc 11-22/570r3 presented a resolution for NSTR case described by CID6422. The resolution presented in this doc focuses on the EMLSR case and potentially can be extended to other MLO channel access mode (not in this doc).

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

*TGbe editor: Please append the following text in 35.9.4.1 after the last paragraph: (#4712, 4713, 4769, 6062)*

(#4712, 4713, 4769, 6062)An EHT AP with dot11RestrictedTWTOptionImplemented set to true as a TXOP holder shall ensure the TXOP ends before the start time of each r-TWT SP advertised by itself unless the EHT AP transmits DL frames of r-TWT DL TID(s) to or solicits the UL frames of r-TWT UL TID(s) from r-TWT member STAs at the beginning of the r-TWT SP.

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| **CID** | **Commenter** | **Clause** | **Page/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4716 | Chittabrata Ghosh | 35.6.4 | 298.42 | Define a r-TWT termination mechanism that terminates the existing r-TWT agreement setup (not existing other b-TWT sessions) | Define a mechanism either by reusing TWT Information frame where absence of Next TWT subfield is an indication of r-TWT setup suspension or another mechanism | **Rejected** – no consensus is reached in the group yet to come up with changes satisfying the comment. |
| 6418 | Muhammad Kumail Haider | 9.4.1.60 | 111.30 | The usage of TWT Information field in context of suspension/resumption of r-TWT schedules needs clarification. Further, it should be specified whether All TWT applies to r-TWT SPs as well or onlt non-rTWT braodcast TWT SPs. b-TWT operation is focused on power saving whereas r-TWT operation is primarily focused on facilitating latency sensitive traffic, and as such, their signaling should be seaprated as needed to accommodate various use-cases. | Please clarify the TWT Information field usage in context of r-TWT operation. Modify signaling as needed to accommodate r-TWT schedule suspension/resumption. | **Rejected** – Use of TWT Information frame is same for rTWT as is for bTWT, so based on baseline spec, All TWT applies to all bTWT schedules including rTWT schedules. Agree in principle on problem(s) identified however no consensus is reached yet in the group to provide changes satisfying the comment. |
| 6419 | Muhammad Kumail Haider | 9.4.1.60 | 111.30 | Currently TWT Information field lacks fields to identify specoific bTWT schedules, only All TWT field is there. As we expand usage to r-TWT operation, it will be useful to add signaling capability to indicate a particular r-TWT schedule the TWT Information field applies to. | Revise TWT Information field to signal a particular r-TWT schedule | **Rejected** – agree in principle on the problem however no consensus is reached yet in the group to provide changes satisfying the comment. |
| 4718 | Chittabrata Ghosh | 35.6.3 | 298.32 | Define agreement setup procedure when EHT AP corresponds to a nontransmitted BSSID in a multiple BSSID set or belongs to a co-hosted BSSID set and with dot11RestrictedTWTOptionImplemented set to true | As in comment | **Rejected** – a resolution hasn’t been reached consensus. The commenter can bring the comment and/or solution in next LB. |
| 4721 | Chittabrata Ghosh | 9.4.2.295b.3 | 135.53 | A STA affiliated to either a non-AP MLD or an AP MLD should advertise about restricted TWT support in ML Probe Request and ML Probe Response variant MLE (STA profile) in case the reporting STA does not support restricted TWT operation | Please define restricted TWT support subfield in STA Control field in Per-STA Profile subelement | **Rejected.**Beacons/Probe Response frames do not carry STA profile unless conditions in 35.3.10 are met. Even then, the per-STA profile is partial. This is designed to limit the size of these frames and prevent frame bloating. A non-AP MLD is expected to either perform passive/active scanning on each link that is interested in or perform ML probing to gather information of all the links. ML probe response with complete profile carries the EHT Capabilities element and (Re)Association Response frame always carries the EHT Capabilities element in the per-STA profile corresponding to other affiliated STAs. Therefore, r-TWT capabilities of other STAs of the MLD can be determined via active/passive scanning on the respective link, ML probing or during (re)association. |
| 4773 | Chunyu Hu | 35.6.2 | 299.23 | When a non-AP STA has a rTWT setup with AP over link1, and wants to switch to operate on a different link (multi-link resetup) and also switch rTWT to operate on that new link, it's not clear accordingly to the current draft, how to do it without disrupting latency sensitive traffic flow delivery. Requiring a rTWT tear-down/re-setup can disrupt the traffic, and cause too much overhead. | Will bring in a solution | **Rejected** – lack of sufficient details on proposed changes to resolve the comment. |
| 4774 | Chunyu Hu | 35.6.2 | 299.23 | A non-AP STA may want to switch the operating link for an established rTWT agreement. Currently such a transition mechanism is missing. | As commented. | **Rejected** – the r-TWT STA may follow the procedures specified in 35.3.5 (setup), 35.3.6 (reconfig) and 35.3.7 (link mgmt.) e.g. to switch the operating link, and re-setup the r-TWT membership. The transition may happen with these existing mechanisms, even may not be optimal.  |
| 6676 | Rajat Pushkarna | 35.6.1 | 298.12 | "A non-AP EHT STA establishes membership for one or more restricted TWT schedules with its associated EHT AP...", 26.8.3 describes how a HE AP broadcast the TWT capabilities to the non-AP STA whereas here it is stated that a non-AP EHT STA will establish a membership. It is not very clear how is the membership being established here. | The negotiation procedure cited in 26.8.3 is an optional feature. Not clear how the membership is established for non-AP EHT STA | **Rejected** – 26.8.3 (Broadcast TWT operation) covers the membership establishment procedure. E.g. Table 26-7 (Broadcast TWT membership exchanges). The additional rules for r-TWT is seen in 35.9.2. The part of being “optional” or not is not a problem – the setup is only between EHT STAs supporting r-TWT. |
| 6415 | Muhammad Kumail Haider | 35.6.3 | 298.30 | The text specifies that modified version of broadcast TWT element shall be used for restricted TWT schedule announcements in Management frames as specified in 26.8.3 (Broadcast TWT operation). However, the specified carrying frames for announcements are all broadcast, and exclude individually addressed frames such as individual probe response and TWT Information frames. There should be a mechanism for a STA to retrieve the latest r-TWT schedule information "on-demand" instead of waiting for the next broadcast announcement e.g., beacons. | Introduce signaling to enable a STA to request latest r-TWT schedule in an individually addressed frame. | **Rejected** – the concerned problem was discussed in doc 11-21/1147. However, the group didn’t reached consensus on necessary changes satisfying the comment right now. |
| 6949 | Saju Palayur | 35.6.4.1 | 298.40 | current normative does not specify if TXOP holder shall ensure TXOP ends for Restricted TWT advertised on BSS or also OBSS ? | Please specify | **Rejected** – the question in comment raised a valid point. CR doc 11-21/1147 intends to cover it, however the group didn’t reach consensus on necessary changes satisfying the comment right now. |
| 7429 | SunHee Baek | 35.6.4.1 | 298.45 | In broadcast TWT, a beacon frame deliveries schedules information of TWTs to STAs. Since doze state of power save mode and channel interference, member STAs may miss the scheduling information of rTWT. | The additional method is needed to share scheduling information of restricted TWT except beacon frame. | **Rejected** – the group didn’t reached consensus on necessary changes satisfying the comment. |
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| 4720 | Chittabrata Ghosh |   | 0.00 | Do we think that an EHT AP still needs to advertise TIM indication for r-TWT STAs in PS mode in a ML traffic element present in a Beacon when there is no r-TWT SP scheduled in the corresponding Beacon Interval? | As in comment | **Rejected** – R-TWT rule doesn’t disallow STA to tx/rx outside of SP as defined in the latest draft. So answer is yes – to keep the flexibility for the STA if it chooses to wake up outside of r-TWT SP to poll the packet. |
| 4776 | Chunyu Hu | 35.6 | 298.58 | If an rTWT agreement is established associated with a TID (as specified in the Restricted TWT Traffic Info field in the Restricted Parameter Set field), and if the rTWT STA is affiliated with a MLD, do we allow MSDUs of this TID to be delivered over other links at any time? If yes, it seems diminishing the usage of rTWT SPs (waste setup, have to waste termination signaling for most SPs) if the rTWT STA always or most of time has delivered MSDUs of this TID over the other link. If no, there is downside of losing the MLO benefit -- if the medium is busy during that rTWT SP, the rTWT STA could instead use the other link that's free to deliver the packets of this TID. Should introduce a satisfying solution and develop draft text. | As in comment. | **Revised** – changes accepted into 35.9.5 (Traffic delivery) allows the traffic including those of r-TWT TID to be transmitted outside of SP (‘should’) and also the rule agreed doesn’t disallow them to be tx’d over other link(s). **TGbe editor: no change is needed.** |
| 6386 | Morteza Mehrnoush | 35.6.4 | 298.37 | In rTWT, if the SP of the rTWT is short and the STA couldn't transmit any traffic by the end of the current SP (WM being busy due to different reasons for the whole SP duration), there is no mechanism for the STA to transmit it's low latency traffic after the end of the original SP. This scenario is different from the SP extension because in this scenario the end of current SP is already reached and we want the STA to transmit after the end of original SP. This scenario is important for the low latency STAs to transmit the traffic within delay bound. Please add text to cover this scenario. | as in comment | **Revised** – changes accepted into 35.9.5 (Traffic delivery) allows the traffic including those of r-TWT TID to be transmitted outside of SP (‘should’).**TGbe editor: no change is needed.** |
| 6866 | Rubayet Shafin | 35.6 | 297.57 | For Restricted TWT (rTWT) operation, if an STA is done with transmitting latency-sensitive packets in uplink before the end of restricted TWT service period (SP) and there is no packet waiting for that STA in downlink for remainder of the SP, then it causes channel under-utilization for that STA if the STA is prohibited to transmit latency-tolerant traffic for remainder of the SP. Channel under-utilization due to under-utilized restricted TWT SP can be reduced by allowing latency-tolerant traffic in addition to latency-sensitive traffic for transmission during rTWT SP. Once the scheduled STA is done transmitting latency-sensitive traffic during rTWT SP, and if there is still time remaining in the SP, the scheduled STA can choose to transmit its latency-tolerant packets (if any) during remaining of the SP. This will improve the channel utilization for the STA . However, it creates fairness issue. Regarding contention among the scheduled STAs, if one scheduled STA starts transmitting latency-tolerant traffic during the restricted TWT SP, it is not fair for other scheduled STAs that are still transmitting latency-sensitive traffic during the SP. Also, an STA with ill intention may abuse this functionality by setting up TWT parameters such that there is always additional time left in the restricted TWT SP after transmitting latency-sensitive packets. | Commenter will provide a contribution to address this issue related to restricted TWT. | **Rejected** – 35.9.5 (Traffic delivery): the LST traffic is prioritized during r-TWT SP but non-LST traffic is still allowed. Further changes haven’t reached consensus in the group. |
| 6385 | Morteza Mehrnoush | 35.6.2 | 298.22 | The periodic OPS (opportunistc power save) in section 26.14.3 (802.11ax-D8.0) can be enabled by including a TWT element in beacons to set a periodic Broadcast TWT SP with these information: the Broadcast TWT Recommendation field equal to 3 and the Broadcast TWT ID subfield equal to 0.In order to use the periodic OPS in context of rTWT, please add text to consider the Broadcast TWT Recommendation field equal to 4 to enable the periodic OPS. | as in comment | **Rejected** – 11be D1.5 has the text *“(#2920)The Broadcast TWT ID subfield in a Restricted TWT Parameter Set field is always set to a nonzero value*”. Hence this precludes the r-TWT SP to be used to support the periodic OPS. An alternative way would be needed to enable OPS using r-TWT, if agreed to – which the comment didn’t cover. |
| 7632 | Tomoko Adachi | 35.6.2 | 0.00 | It may be good to add a new Reason Code field value to be able to disassociate an EHT non-AP STA that said it supports restricted TWT but transmits non-latency sensitive traffic during restricted TWT service period. | As in comment. | **Rejected** – it’s been agreed that the traffic of r-TWT TIDs is prioritized during r-TWT SPs and other traffic are still allowed. As such, there is no need to penalize this behavior by disassociating such STAs in the comment. |
| 7845 | Yonggang Fang | 9.4.2.29 | 0.00 | Wireless transmission link is not very reliable. As result it will impact performance of time sensitive applications in Wi-Fi network and degrade user experience. | Please specify a method to improve transmission reliability, especially for time sensitive traffic transmission. | **Revised** – the SP start time protection as defined in D1.0 reduce contention/collision at SP start time. Further more, the traffic prioritization rules as described in 35.9.5 (Traffic delivery) give more chance for the LST to be delivered during the r-TWT SP. Both improve reliability. Further suggestion on improving can be submitted in next run.**TGbe editor**: no change is needed. |
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| 4588 | Bo Yang | 9.3.1.2235.7.4 | 0.00 | When there are multiple low latency TIDs, AP is not able to use the existing basic trigger mechanism to trigger specified low latency TIDs for uplink transmission. | Define a supplementary mechanism for triggering low latency TIDs | **Rejected –** no consensus is reached in the group at this point on necessary changes. |
| 4768 | Chunyu Hu | 35.6 | 298.58 | In trigger-enabled TWT operation, trigger frame sequence is the main frame sequence for delivering UL traffic. The basic trigger frame contains a <preferred AC> in the per user field. In rTWT operation, rTWT SP is associated with TIDs. The mapping between TID and AC is many to one. We need to clarify how rTWT scheduled STA interprets the <preferred AC> field, or revise the the <preferred AC> field to resolve this mis-match and serve the intention of supporting latency sensitive traffic identified by TIDs. | As commented. | **Rejected** – no consensus is reached in the group at this point on necessary changes. |
| 5874 | Liangxiao Xin | 35.6 | 297.57 | During the R-TWT SP, AP needs to reuqest BSR from the member STAs for arranging the transmssions for the latency sensitive traffic. However, the current BSR is not able to differentiate the buffer of latency sensitive traffic from other traffic | need a BSR variant to report the buffer of the latency sensitive traffic with necessary QoS parameters, such as expiration time. | **Rejected** – no consensus is reached yet in the group to provide changes satisfying the comment. |
| 8063 | Yuchen Guo | 9.2.4.6.3a | 71.17 | BSR for low latency is missing. Need to define a new type of BSR to indicate low latency traffic. | as in comment | **Rejected** – no consensus is reached yet in the group to provide changes satisfying the comment. |
| 4765 | Chunyu Hu | 35.6 | 298.58 | Currently TWT is lack of a signaling mechanism for TWT SP to terminate based on participating STAs' traffic. See this example: STA1 is a member of a TWT SP. STA1 transmitted 10 packets to AP and is done with all its UL traffic. It wants to terminate the SP but \*only if\* the AP has also finished the DL traffic to it. If it tells AP using the existing TWT SP early termination signaling as specified in 26.8.5 (Power save operation during TWT SPs), and the AP still has pending DL packets to STA1, the SP would be terminated without completing all DL traffic and that's not what STA1 intends to. Vice versa. Both sides, in typical or at least many cases, want to terminate SP only afer all pending DL/UL traffic has been delivered.While this problem is common to all types of TWT (iTWT, bTWT/rTWT), specifically and ideally should be resolved for all TWT, we can consider defining the solution in EHT new feature rTWT first. | A signaling or procedure is needed to allow a participating STA to indicate or respond to the other side that it's status of "now I am ready to terminate (and will if you are as well)"; or "I'm ready to terminate, please terminate if you are. okay as well." Will bring in a proposal to solve this problem. | **Rejected** – no consensus is reached yet in the group on changes satisfying the comment. |
| 5875 | Liangxiao Xin | 35.6.4 | 298.37 | R-TWT SP should be stopped earlier if the latency sensitive frame exchange finishes earlier than the scheduled end time of R-TWT SP for the sake of the channel utilization efficiency. | AP should ends the R-TWT SP earlier and allows other STAs to transmit after that | **Rejected** – r-TWT SP can be early terminated following the procedure defined in 802.11axD8.0 26.8.5 (Power save operation during TWT SPs). The comment fails to identify any problem in this baseline procedure. |
| 6417 | Muhammad Kumail Haider | 26.8.5 | 241.01 | The 802.11ax text specifies: "A STA participating in multiple TWT SPs that overlap in time stays in the awake state until the latest AdjustedMinimumTWTWakeDuration time of all of the TWT SPs expires, except that a TWT SP termination event causes all of the overlapping TWT SPs to terminate." Spec should specify any difference in SP termination events for r-TWT vs b-TWT, and also STA behavior in overlapping b-TWT and r-TWT SPs if they occur. | Please clarify the behavior. Further, AdjustedMinimumTWTWakeDuration should be tracked separately for b- and r-TWT. |  **Rejected** – as the SP termination procedure still stays the same as baseline, the comment fails to identify the need to differentiate the handling of r-TWT SP from other. As of the proposed change, don’t see the need to track this period of time differently for r-TWT. |
| 8052 | Yuchen Guo | 35.6 | 297.58 | After the restricted TWT is setup, the STAs without low latency traffic are not supposed to transmit. However, when all the low latency traffic are transmitted in the rTWT SP, if the rTWT SP has not ended, the STAs are still not able to transmit, this will result in a waste of resource. Please define a mechanism to ternimate the rTWT SP when all the low latency traffic are transmitted. | The commenter will bring a contribution to resolve it. | **Rejected** – r-TWT SP can be early terminated following the procedure defined in 802.11axD8.0 26.8.5 (Power save operation during TWT SPs). The comment fails to identify any problem in this baseline procedure.Also note that the first statement in comment is not the case as the newly added 35.9.5 (traffic delivery) defines – LST is prioritized but non-LST is not forbidden per se. |
| 4766 | Chunyu Hu | 35.6 | 298.58 | rTWT operation aims at delivering targeted QoS requirements and intending to deliver all pending packets within the SP. The SP duration should be setup long enough to deliver the traffic load. However, on one hand one doesn't want to define a too long SP (for seek of network service capacity), and on the other hand, there can be some portion of SPs subject to hiccups due to various reasons we see in real life (retransmission, calibration, other overheads like sounding, noise/interference surge, or time lost to contention from non-participating or non-rTWT-supporting STAs). There is a need to extend the SP on the fly to handle this case with some constraint in mind, e.g., not affect SPs of other agreements that are right after the current SP/agreement. | A signaling mechanism is needed to allow the extension of a SP on per SP basis to handle the traffic overlow problem described. Will bring in a proposal. | **Rejected** – no consensus is reached yet in the group on changes satisfying the comment. |
| 5520 | Jinsoo Choi | 35.6.3 | 298.32 | The start time of the restricted TWT SP can be affected due to the busy WM or unpredictable situation/randomness of the low latency traffic. (e.g. some STAs that doesn't support the restricted TWT so cannot obtain the announcement of the restricted TWT SP from the associated AP, or OBSS STAs during the restricted TWT SP) Then the total duration of the restricted TWT SP is reduced, which may not be able to provide enough time for satisfying the requirement of latency sensitive data/traffic delivery. In this case, the AP may need to delay the start time of the restricted TWT SP and this extended SP needs to be signaled to the member STAs. | Need to define how to extend the restricted TWT SP and announce this information to the STAs. | **Rejected** –no consensus is reached yet in the group to provide changes satisfying the comment. |
| 7427 | SunHee Baek | 35.6.4.1 | 298.45 | If the starting time of the restricted TWT is affected by unexpected things (e.g., the transmission of OBSS/non-member STAs), the scheduled total duration of restricted SP is reduced, which may not be able to provide enough time for the latency sensitive data/traffic delivery. In this case, the later part of latency sensitive traffic cannot be finished within the remaining time of the SP. | The start time of the restricted TWT SP can be affected by the LL traffic pattern, the preceding TXOP of the STA that does not support the restricted TWT, or OBSS. So the end time of the restricted TWT SP may be extended.By extending the end time of the restricted TWT SP, the low latency STA can have enough of the medium access time for transmitting the latency sensitive data/traffic. | **Rejected** –no consensus is reached yet in the group to provide changes satisfying the comment. |
| 7428 | SunHee Baek | 35.6.4.1 | 298.45 | If the restricted TWT's end time is extended, the AP shall announce the extension to member STAs. There is needed to define a signaling method for rTWT's extension. | The signaling method can be defined based on TWT information field or TWT Setup Command in Unsolicited TWT Setup Action frame, etc. The frame shall be sent by AP during rTWT SP(means between the start time to exchange LLD and initial end time of rTWT SP). | **Rejected** – no consensus is reached yet in the group to provide changes satisfying the comment. |
| 7859 | Yonggang Fang | 35.6.4.1 | 298.44 | Suggest to clarify whether the restricted TWT SP is allowed to extend or not. If restricted TWT is not allowed to extend, the time sensitive transmission started within a restricted TWT SP shall not go beyond the restricted TWT SP. | Please add this rule. | **Rejected** – Note that the LST can be still delivered outside of r-TWT SP, see 35.9.5 (Traffic delivery). The SP extension as a general topic was discussed; however no consensus is reached yet in the group to provide changes satisfying the comment. |
|  |  |  |  |  |  |  |
| 6476 | Osama Aboulmagd | 3.1 | 37.11 | The term "Higher Priority" in the definition P37L11 needs to be related to other capabilities as defined by the different access categories and indicate higher priority with respect to what. | As in comment. | **Revised** – Per 11be D1.5, #4091 CR added a reference to subclause 35.17 (EPCS priority access).**TGbe editor: no action is needed.** |
| 6478 | Osama Aboulmagd |   | 0.00 | The use of the words "latency" and "jitter". While I understand the use of "latency" is becoming frequent, It is also true that in the traffic engineering literatures the words "delay" and "delay variations" are commonly used. Just check and traffic and queueing book like Kleinrock Vol. 11. It talks about packet delay not packet latency. In fact latency is becoming sort of a slang used in place of the appropriate work "delay". Definition of latency in https://www.oxfordlearnersdictionaries.com/definition/english/latency?q=latency is the condition of existing, but not being clear, active or well developedoutbreaks of disease followed by periods of latency while the definition of delay https://www.oxfordlearnersdictionaries.com/definition/english/delay\_1?q=delay is a period of time when somebody/something has to wait because of a problem that makes something slow or late which is more applicable to traffic delay. | replace the word latency with delay in the whole draft. Replace jitter with delay variations in the whole draft | **Rejected** – disagree that latency is just a slang, and the proposed changes. Please see a few definitions and discussions as follows:1)https://dictionary.cambridge.org/us/dictionary/english/latency defines “the delay between an instruction to transfer (= move) computer information and the information being transferred, for example over the internet:”; 2) https://www.callstats.io/blog/2018/03/07/difference-between-jitter-and-latency-webrtc). Further, latency in the network context is well understood and commonly used (vs. the more generic term ‘delay’). 3gpp standard also uses latency when describing the performance requirement: https://www.3gpp.org/news-events/1831-sa1\_5g.Jitter is “a variance in latency or the time delay between when a signal is transmitted and when it is received” according to https://www.ir.com/guides/what-is-network-jitter and many similar articles. Article (https://www.keysight.com/us/en/lib/resources/training-materials/jitter-and-delay-variance--a-clarification-of-terms-116547.html) also points out that “the terms ‘jitter’ and ‘delay variance’ are often used synonymously. In addition, jitter is concise to use.The terms are also used in existing 802.11me. 11be PAR (11-18/1231r6) also use latency: “This amendment defines at least one mode of operation capable of improved worst case latency and jitter.” |
|  |  |  |  |  |  |  |
| 4662 | Brian Hart | 35.6.4.1 | 298.42 | For Restricted TWTs to have market value, they need to have general support of all STAs in the BSS | All EHT STAs need to respect all the Restricted TWTs within their BSS. Good options: a) make it mandatory for STAs in a BSS to respect Restricted TWTs accepted by the AP of the BSS, and/or b) like VHT/HE, add a "BSS membership selector value" or similar so that STAs that don't respect Restricted TWTs know they cannot even associate | **Revised.**Agree in principle. A) Added a new field in operating element, and b) the suggested change has been added in 11-22/548 (SP passed 03/30) as resolution to CID 4517.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |
| 4770 | Chunyu Hu | 35.3 | 246.15 | Motion 112 (#SP49) has passed (An MLD AP may offer differentiated quality of service over different links) in the context for delivering latency sensitive traffic service. However, in current rTWT text, there hasn't been any design reflecting this, but there should be -- a design addressing this question "how to deliver desired QoS for latency sensitive traffic using rTWT in multi-link operation." | Consider a differentiatiating service advertisement or requirement over selected links. Note: the fix could be in either the 35.6 subclase or appropriate subclause in 35.3 MLO. | **Revised** – agree in principle.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |
| 4771 | Chunyu Hu | 35.6 | 298.58 | In addition to legacy STA issue, it's optional for an EHT STA to support rTWT and stop its TXOP to avoid go across the boundary of the rTWT SP start time. This degrades the effectiveness of rTWT SP protection. One should think making an operating mode to allow the BSS (in absence of MLO) or some links (w/ MLO) to support rTWT required. It would provide network deployment a useful tool. | As commented. Will bring in a proposal. | **Revised.** Agree in principle. Added a new field in operating element.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |
| 4934 | Eldad Perahia | 35.6 | 298.06 | "An EHT STA that supports restricted TWT operation shall set dot11RestrictedTWTOptionImplemented to true and the Restricted TWT Support subfield in transmitted EHT Capabilities elements to 1; otherwise, the STA shall set dot11RestrictedTWTOptionImplemented to false and the Restricted TWT Support subfield in transmitted EHT Capabilities elements to 0." Allowing this feature to be optional in non-AP STAs means that there will be EHT client devices that do not support it and will impede low latency traffic. EHT will not be able to meet its low latency goals | Make support mandatory | **Revised.** Agree in principle. Added a new field in operating element.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |
| 4936 | Eldad Perahia | 35.6.4.1 | 298.42 | "A non-AP EHT STA with dot11RestrictedTWTOptionImplemented set to true as a TXOP holder shall ensure the TXOP ends before the start of any restricted TWT service periods if the TXOP is obtained outside of a restricted TWT service period." Again, this means that non-AP EHT STAs not supporting can an will ignore restricted TWT service periods, killing any chance for successful delivery of low latency traffic | Make support mandatory | **Revised.** Agree in principle. Added a new field in operating element.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |
| 4938 | Eldad Perahia | 35.6.4.2 | 298.49 | "may schedule a quiet interval that overlaps with a restricted TWT service period". What is the point of restricted TWT feature if we need to use Quiet mechanism to manage the poorly behaving non-AP STAs? | Make support for restricted TWT mandatory | **Revised.** Agree in principle. Added a new field in operating element.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |
| 5082 | Gaurav Patwardhan | 35.6.4.1 | 298.42 | Not just EHT STAs with dot11RestrictedTWTOptionImplemented set to true but all EHT STAs need to ensure that their respective TXOPs end before the start of a restricted TWT service period. Otherwise, in a BSS with with mixed TID traffic, the SLAs required by low latency traffic which is sent in the restricted TWT service period will not be met. | Change the sentence to "A non-AP EHT STA as a TXOP holder shall ensure...." | **Revised.** Agree in principle. Added a new field in operating element.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |
| 5771 | Laurent Cariou | 35.6 | 297.58 | As currently defined, restricted TWT is mainly restricted for the member and less for the non-member or even less for an EHT non-AP STA not supporting restricted TWT. Could there be more benefits to increase the usefulness of this feature. |   | **Revised.** Agree in principle. Added a new field in operating element.**TGbe editor please implement changes as shown in this doc tagged by 4771.** |

# 9.4.2.311 EHT Operation element

***TGbe editor: modify Figure 9-1002b as follows:***

The EHT Operation Parameters field is defined in [Figure 9-1002b (EHT Operation Parameters field for-](#bookmark119) [mat(#6603, 4771))](#bookmark119).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 B3 | B4 B7 |
|  | EHT Operation Information Present | Disabled Subchannel Bitmap Present | Restricted TWT Requirement | Reserved |
| Bits: | 1 | 1 | 2 | 4 |

**Figure 9-1002b—EHT Operation Parameters field format(#6603)**

***TGbe editor: insert the following after the paragraph (The Disabled Subchannel Bitmap Present subfield is set to 1 …) (D1.5P186L49) as follows:***

(#4771)The Restricted TWT Requirement subfield is set by an EHT AP as follows:

* Set to 0 if the AP has no preference or requirement for its associated non-AP EHT STAs in terms of the r-TWT operation support.
* Set to 1 to indicate that the AP prefers that its associated non-AP EHT STAs support the r-TWT operation.
* Set to 2 to indicate that the AP requires that its associated non-AP EHT STAs support the r-TWT operation.
* Value 3 is reserved.

The Restricted TWT Requirement subfield is reserved for a non-AP EHT STA.

**35.9.1 General**

***TGbe editor: insert the following before the last paragraph (A non-AP EHT STA establishes …):***

(#4771)An EHT AP may indicate its preference or requirement of all its associated non-AP STAs of their support of r-TWT by setting its Restricted TWT Requirement subfield to a value in range 0 to 2 in the EHT Operation element it transmits as described in 9.4.2.311 (EHT Operation element).