**IEEE P802.11  
Wireless LANs**

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| **Restricted TWT Spec Text**  **Restricted TWT Additional Rules** | | | | |
| **Date:** 2021-10-11 | | | | |
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**Abstract**

This submission proposes resolutions for the following CIDs (12) for TGbe CC36:

4121, 4719, 4767, 4775, 5728,

5775, 5887, 7471, 5664, 5886,

6410, ~~6411~~

~~4779, 4780~~, ~~5348~~,

Revisions:

* Rev 0: Initial version of the document
* Rev 1 : address comments from Shawn, Stephane, Kiseon and Edward, include CID 5664.
* Rev 2 : use “member r-TWT schedule STA” in applicable sentences.
* Rev 3 : incorporate feedback received during the meeting 2021-12-09 (partially presented). In particular, move changes in 35.7.5.1 to the TWT operation and adjust heading # in 35.7.5 accordingly.
* Rev 4 :
  + Simplify resolution to CID 4767 (trigger-enabled SP);
  + Revise (traffic delivery) subclause to remove contentious parts;
  + Defer CIDs related to power saving as some feedback was that the ‘problem’ is in baseline and we should first clarify in baseline. Remove CIDs 4779, 4780 and 5348 from this doc.
* Rev 5: added related CIDs 5886, 6410, 6411 that share resolution covered by this doc.

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 D1.3 and P802.11meD0.4.***

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| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4767 | Chunyu Hu | 35.6.4 | 298.37 | The new triggering mode as defined in 35.2.1.3 (Triggered TXOP sharing procedure) should be defined as the triggered-enabled TWT operation as well. In particular, it would enhance the rTWT operation due to the additional support (p2p e.g.) and flexibility this new procedure introduces and the trigger-enabled operation could be a preferred channel access method for rTWT. | As commented. | **Revised.**  Agree in principle. Feedback suggested that this should be a change common to TWT baseline.  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 4767.** |
| 4775 | Chunyu Hu | 35.6 | 298.58 | rTWT is intended for latency sensitive traffic but the current text e.g. in Table 9-297a (D1.1 page 127, line 57, row for value 4) or subclause 35.7 doesn't have any description on how this intention is realized. We need to consider DL/UL/direct-link of participating STAs as well as non-participating STAs; DATA, management and control frames, and also when MU is possible to utilize additional subchannels or spatial streams that are not used by or allocated to participating rTWT STAs. Also need to consider in the scenario where all the latency sensitive traffic has been delivered and the current SP still has time -- terminate the SP or use it for other traffic for the rTWT STAs and/or other STAs. There were discussions over 11-21/462 but it was agreed to remove contents on this aspect to future development due to time limit. | Will bring in presentation to complete this part. | **Revised.**  **Agree in principle.**  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 4775.** |
| 4121 | Akira Kishida | 35.6.2.1 | 298.01 | Priority in latency sensitive traffic or TID should be clarified when operating on restricted service periods. In other words, some prioritization between TIDs in restricted service periods should be clarified. | As in comment. | **Revised.**  **Agreed in principle.**  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 4121.** |
| 5728 | Kengo Nagata | 35.6.2.1 | 298.01 | Priority in latency sensitive traffic or TID should be clarified when operating on restricted service periods. In other words, some prioritization between TIDs in restricted service periods should be clarified. | As in comment. | **Revised.**  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 5728.** |
| 5775 | Laurent Cariou | 35.6.4 | 298.37 | It is useful to indicate the TIDs that are targeted to be used for this rTWT. However, we don't need to define too restrictive rules to limit the traffic within the TWT to only these TIDs. Without this, these TIDs will be prioritized anyway cause that's why the AP and STA negotiated that SP. Benefits or further limiting TIDs seem very minor, while loosing on flexibility and creating yet another restriction for the STA that is supposed to be prioritized. Also trigger access during the SP already can be steered using the preferred AC of the trigger frame. | Don't define restrictive rules regarding TIDs during a rTWT SP. | **Revised.**  **Agreed in principle.**  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 5775.** |
| 7471 | Thomas Handte | 35.6.4 | 298.37 | Restricted TWT requires a mechanism to allow other traffic than latency sensitive traffic to be conveyed in a restricted TWT SP. This is important to keep efficiency of protected periods. | If there is time remaining within a restricted TWT SP and all latency sensitive traffic is conveyed, the restricted TWT SP should be open for any other traffic to be transmitted or for STAs having non-latency sensitive traffic. The author is happy to assist in drafting a resolution for this comment. | **Revised.**  **Agreed in principle.**  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 7471.** |
| 5664 | Julien Sevin | 35,6,4,1 | 298.42 | At the current stage, no mechanism for ensuring that a station uses efficiently its low latency resources | Add a mechanism for ensuring that a station uses efficiently its low latency resources by monitoring the "a priori" low latency traffic. | **Revised**  Agree in principle. Defined the rules for the r-TWT STA to prioritize latency sensitive traffic in r-TWT SP.  **TGbe editor, please make change as shown in this doc 11-21/1802, tagged by 5664.** |
| ~~4779~~ | ~~Chunyu Hu~~ | ~~35.6~~ | ~~298.58~~ | ~~rTWT is built up using bTWT signaling and rules as baseline. However, there are rules in bTWT that rTWT supporting STAs may not want to support because a) it adds the burden and rTWT focuses on latency sensitive traffic use cases; b) there are additional rules like power save that rTWT STAs may want to avoid). E.g. current bTWT has rules that require bTWT STAs to wake up over bTWT SPs as specified in P802.11axD8.0 (page 422, 31-53), but if STAs implementing rTWT may not want to wake up for other bTWT SPs to save power.~~ | ~~Please develop additional rules that allow rTWT supporting STAs to reduce its operation complexity and to optimizes power saving focusing on rTWT operation.~~ | **~~Revised.~~**  **~~TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 4779.~~** |
| ~~4780~~ | ~~Chunyu Hu~~ | ~~35.6~~ | ~~298.58~~ | ~~rTWT SPs are set up to prioritize latency sensitive traffic identified by TIDs. The power saving behavior with this change needs to be examined and additional rules or descriptions may need to be added.~~ | ~~Will bring in contribution to discuss.~~ | **~~Revised~~**  **~~TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 4780.~~** |
| 4719 | Chittabrata Ghosh | 35.6.3 | 298.32 | Clarify an EHT STA's use of PM bit and PS mode for TWT requesting, scheduled and r-TWT scheduled STAs | As in comment | **Rejected.**  **Discussed offline to clarify intention and agreed intended coverage is already in baseline. See discussion as well.** |
| ~~5348~~ | ~~Jarkko Kneckt~~ | ~~35.6.3~~ | ~~298.35~~ | ~~STAs that have setup Restricted TWT flow should be available only during the rTWT SPs that belong to the rTWT Flow. The rTWT shall not be available for all SPs in the remaining Beacon interval as defined for BC TWT operation. rTWT likely has very frequenctly repeating SPs and waking up for all of the rTWT SPs will cause very bad~~ | ~~Please specify: Non-AP STA that has setup rTWT flow is avilable only during the SPs belonging in rTWT flow and the STA does not need to wake up for other BC TWT SPs.~~  ~~Please specify that BC TWT STAs do not need to wake up for rTWT SPs.~~ | **~~Revised~~**  **~~TGbe editor, please make change as shown in this doc 11-21/1802 tagged by 5348.~~** |
| 5886 | Liangxiao Xin | 9.4.2.199 | 298.34 | In current TWT rule, the member of a TWT is not allowed to contend the channel outside the R-TWT SPs. We may allow a member STA of R-TWT to contend the channel outside the R-TWT SPs. | add a procedure to allow R-TWT member STA to contend the channel outside the R-TWT SP. | **Rejected**  Current TWT/R-TWT rule does not prohibit a TWT scheduled STA to contend channel outside r-TWT SPs. Please refer to 26.8.3.3 |
| 5887 | Liangxiao Xin | 9.4.2.199 | 298.34 | need to define a procedure whether R-TWT member STA will be awake outside R-TWT SP | Same as in the comment | **Revised.**  While I think the PS mode is independent of TWT per baseline and there is no need to change that aspect, I reckon there is some additional rule related to whether it is allowed to transmit outside of r-TWT SPs.  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged as 5887.** |
| 6410 | Muhammad Kumail Haider | 9.4.2.199 | 126.18 | A PDT and motion(#2920) was passed to make changes to TWT element to accommodate restricted TWT schedule announcements and negotiations. According to this PDT, the Trigger subfield in Request Type field applies to restricted TWT Parameter set fields as well. However, the Trigger subfield definition in current text encompasses triggering frames specified in 26.8 (TWT Operation). As such, it precludes the MU-RTS TXS mechanism introduced in 35.2.1.3, which can be useful for managing channel access in r-SP and support p2p traffic within SP. | Modify TWT element text to include MU-RTS-TXS procedure introduced in 35.2.1.3 as a triggering mechanism. Revise as needed to enable STA to indicate MU-RTS-TXS usage in context of p2p traffic within r-SPs. | **Revised.**  Agree in principle.  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged as 6410.** |
| 6411 | Muhammad Kumail Haider | 9.4.2.199 | 126.18 | A PDT and motion(#2920) was passed to make changes to TWT element to accommodate restricted TWT schedule announcements and negotiations. Part of proposed changes is to introduce an r-TWT traffic info field to indicate latency sensitive TIDs. However, it is not specified whether there are any restrictions on the type of frames and whether frames of other TIDs may also be transmitted by member STAs of an r-SP. | Specify if and how TIDs indicated in r-TWT traffic info field are used to restrict certain type of traffic/frames from member STAs in r-SP (in 9.4.2.199 or 35.7). Appropriate restrictions should apply to prioritize and/or limit the usage of r-SPs for latency sensitive traffic delivery, in accordance with the objective of r-TWT operation. | **Revised.**  Agreed in principle. Defined the rules for the r-TWT STA to prioritize latency sensitive traffic in r-TWT SP.  **TGbe editor, please make change as shown in this doc 11-21/1802 tagged as 6411.** |

**Discussion:**

A general clarification for CID 5887, 4719:

An r-TWT scheduled STA may or may not operate in the PS mode. The STA may also switch into or out of the PS mode during a restricted TWT SP; however, the STA is considered as awake during the restricted TWT SP following the rules specified by 26.8 (TWT Operation).

An r-TWT scheduled STA follows the power saving rules as specified in the baseline Power Management rules and 26.8.5 (Power save operation during TWT SPs). The STA should have PM subfield set to 1 if it’s in PS mode.

The above baseline behaviours are sufficient IMO to cover the comments in above CIDs.

Discussion on PS:

Baseline --

A TWT scheduled STA that is in PS mode may enter the doze state after receiving a Beacon frame with a

TWT element indicating the existence of a broadcast TWT and shall be in the awake state at the broadcast

TWT start times for which the STA has indicated it will be awake by any of the following means:

— Establishing a membership for the unannounced broadcast TWT with those broadcast TWT IDs

— Negotiating a wake TBTT and wake interval between Beacon frames that the STA receives, as

defined in 26.8.6 (Negotiation of wake TBTT and wake interval)

— Having sent a PS-Poll or U-APSD trigger frame during the beacon interval

— Having sent another indication that it is in the awake state during that beacon interval

Let’s say there are two bTWT schedule S1 and S2 and in the same beacon interval, there are SP1 and SP2 belonging to S1 and S2, respectively. A STA is a member of S1 but not S2.

| SP1 SP2 |

Tbtt tbtt

The STA sends a PS-Poll in SP1, then according to the condition highlighted, it’s supposed to be awake at the start time of SP2, too. While it might be how general broadcast TWT STAs behave, it’s not desired for r-TWT STAs that target at low latency and also want to save power as much as possible.

Offline discussion is not conclusive yet if the baseline should be clarified and if that’ll address the concern pointed in related CIDs. Defer related CIDs for now.

***TGbe editor: discussion text starts (not to revise draft)--***

Discussion:

Instead of adding text for the 11be amendment in individual/broadcast TWT for AP and non-AP STAs separately, following the IEEE 802.11 style in effort of reducing redundant text, this CR created a new General subclause and a simple paragraph for the amendment common to iTWT and bTWT.

Note: the amendment is to cover the new triggered TXOP sharing procedure that defines new Trigger frame variant (MU RTS TXS Trigger), and that the data frame transmitted by the responding STA(s) are non-TB PPDUs. Note, one example of the baseline text can be found at D802.11ax\_D8.0, P417L23: “*A TWT requesting STA should not transmit frames to the TWT responding STA outside of negotiated TWT SPs and should not transmit frames that are not contained within HE TB PPDUs to the TWT responding STA within trigger-enabled TWT SPs.*”

***TGbe editor: discussion text ends.***

## 35.6 TWT Operation

***TGbe editor: insert the following subclause.***

# 35.6.1 General (#4767, 6410)

(#4767, 6410)A TWT STA shall follow the rules as described in 26.8 (TWT operation) in general. In addition, within trigger-enabled SPs, the trigger frame may be an MU RTS TXS Trigger frame and the procedure follows 35.2.1.3 (Triggered TXOP sharing procedure).

***TGbe editor: modify the title of the subclause as follows.***

# 35.6.2 Individual TWT agreements(#4767, 6410)

## 35.7.2.2 The setup procedure

TGbe editor: insert the following paragraph after the last paragraph in this subclause.

(#4767, 4775, 4121, 5728, 7471, 5664, 6411) The TID(s) that are specified in the Restricted TWT DL or UL TID Bitmap with the corresponding DL or UL TID Bitmap Valid subfield set to 1 in a TWT Response frame that indicates Accept TWT are referred to as r-TWT DL TID(s) or r-TWT UL TID(s), and collectively as r-TWT TID(s), in the following subclause.

TGbe editor: insert the following subclause as follows.

### 37.7.5 Traffic delivery (#4775, #4121, #5728, #5775, #7471, #5664, #5887, #6411)

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. In a trigger-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.

NOTE—The r-TWT scheduling AP might still include the 12 LSB of the AID of a STA that is not a member of this r-TWT SP in Trigger frame(s) transmitted in trigger-enabled SPs.

***TGbe editor: change Table 9-339 (not all rows shown) of P802.11be D1.3 as follows:***

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

|  |  |
| --- | --- |
| **Broadcast TWT Recommendation field value** | **Description when transmitted in a broadcast TWT element** |
| … | … |
| (#2920)4 | The corresponding broadcast TWT service period is referred to as a restricted TWT service period.  (#4775, 4121, 5728, 5775, 7471, 6411) QoS Data frames delivery during a restricted TWT SP among AP and restricted TWT scheduled STAs are prioritized to deliver latency sensitive traffic as described in 35.7 (Restricted TWT).  ~~A broadcast TWT parameter set that has the Broadcast TWT Recommendation field equal to 4 is referred to as a restricted TWT parameter set.~~ |
| (#2920)5–7 | Reserved |

(#4775, 4121, 5728, 5775, 7471, 6411)A broadcast TWT parameter set that has the Broadcast TWT Recommendation field value equal to 4 is referred to as a restricted TWT parameter set.