**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, 4779,

4780, 5348, 5728, 5775, 5887,

7471, 5664

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.

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.** |
| 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 | **Rejected.**  **See discussion.** |

**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.

# 26.8 TWT operation

## 26.8.2 Individual TWT agreements

TGbe editor: revise the first and third paragraphs at Page 4196 in subclause 26.8.2 (Individual TWT agreements) as follows.

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.~~ (#4767)Within trigger-enabled TWT SPs, a TWT requesting STA should transmit frames that are either contained within TB PPDUs to the TWT responding STA, or contained within non-TB PPDUs during the time allocated by the TWT responding STA using the procedure described in 35.2.1.3 (Triggered TXOP sharing procedure) and 35.3.16 (Enhanced multi-link single radio operation).

NOTE 4—The TWT requesting STA decides which frames to transmit within or outside a TWT SP; and while it is recommended that the TWT requesting STA not transmit using EDCA within or outside TWT SPs, the TWT requesting STA might still do so. If the STA decides to transmit, then the STA might contend for access to the medium as defined in 10.23.2 (HCF contention based channel access (EDCA)) and in 26.2.7 (EDCA operation using MU EDCA parameters).

The TWT responding STA of a trigger-enabled TWT agreement shall schedule for transmission a Trigger frame for the TWT requesting STA, as described in 26.5.2 (UL MU operation), (#4767)35.2.1.3 (Triggered TXOP sharing procedure) and 35.3.16 (Enhanced multi-link single radio operation), within each TWT SP for that TWT agreement, except that the Trigger frame may be replaced by a frame carrying a TRS Control subfield, provided that the frame is carried in a DL MU PPDU and the AP allocates enough resources in the HE TB PPDU for the STA to at least deliver its BSRs in response to the soliciting DL MU PPDU. The TWT responding STA should solicit buffer status reports from the TWT requesting STA at the start of the TWT SP following the procedure described in 26.5.5 (Buffer status report operation) or as described in 26.5.7 (NDP feedback report procedure). The TWT responding STA that intends to schedule for transmission additional Trigger frames during a trigger-enabled TWT SP shall set the More TF subfield in the Common Info field of the Trigger frame to 1 to indicate that it will schedule for transmission another Trigger frame within the same TWT SP. The TWT responding STA shall set the More TF subfield to 0 when the Trigger frame is the last scheduled Trigger frame of the TWT SP or when the Trigger frame is scheduled for transmission outside of a TWT SP.

## 26.8.3 Broadcast TWT operation

## 26.8.3.2 (Rules for TWT scheduling AP)

TGbe editor: revise the 5th paragraph at P4201L29-39 in subclause 26.8.3.2 (Rules for TWT scheduling AP) as follows.

The TWT scheduling AP shall schedule for transmission of a Trigger frame addressed to one or more TWT scheduled STAs during a trigger-enabled TWT SP, (#4767)as described in 26.5.2 (UL MU operation, 35.2.1.3 (Triggered TXOP sharing procedure) and 35.3.16 (Enhanced multi-link single radio operation), except that the Trigger frame may be replaced by a frame carrying a TRS Control subfield, provided that the frame is carried in a DL MU PPDU and the AP allocates enough resources in the HE TB PPDU for the STA to at least deliver its BSRs in response to the soliciting DL MU PPDU. A TWT scheduling AP should not include the 12 LSBs of the STA’s AID in a User Info field of a Trigger frame transmitted within a broadcast TWT SP, unless the STA is in the awake state, has established membership in the broadcast TWT with that Broadcast TWT ID, or has indicated to receive the Beacon frame preceding the beacon interval that contains this TWT SP (see 26.8.6 (Negotiation of wake TBTT and wake interval)).

TGbe editor: add the following paragraph after the “NOTE 4—” paragraph at Page 4201, in subclause 26.8.3.2 (Rules for TWT scheduling AP).

(#4767)NOTE 5–The TWT scheduling AP does not intend to schedule for transmission of a MU-RTS TXS Trigger frame with the TXOP Sharing Mode subfield set to 1 (or 2) for the TWT scheduled STA when the STA does not have its Triggered TXOP Sharing Mode 1 (or 2) Support subfield in the EHT Capabilities element set to 1.

## 26.8.3.3 (Rules for TWT scheduled STA)

***TGbe editor: revise the 1st paragraph at P4204 in subclause 26.8.3.3 (Rules for TWT scheduled STA) as follows:***

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). (#4767)Within trigger-enabled broadcast TWT SPs, a TWT scheduled STA should transmit frames that are either contained within TB PPDUs to the TWT scheduling AP, or contained within non-TB PPDUs during the time allocated by the TWT scheduling AP using the procedure described in 35.2.1.3 (Triggered TXOP sharing procedure) and 35.3.16 (Enhanced multi-link single radio operation).

## 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) 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.

## 35.7.5 Additional rules for r-TWT STAs

### 37.7.5.1 Traffic delivery (#4775, #4121, #5728, #5775, #7471, #5664)

An r-TWT scheduled STA should not transmit QoS Data frames of r-TWT UL TID(s) to the r-TWT scheduling AP outside of the restricted TWT SPs that it is a member of.

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, the r-TWT scheduling AP shall first trigger member r-TWT scheduled STAs to facilitate them to first deliver their pending BUs 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 the Trigger frame(s) transmitted in the trigger-enabled TWT SP.

An r-TWT scheduled STA should assist the r-TWT scheduling AP in allocating resources for the transmission of its UL latency sensitive traffic by including BSRs of the r-TWT UL TID(s) in its transmitted QoS Data frames or QoS Null frames during restricted TWT SPs. When a member r-TWT scheduled STA has completed the delivery of its buffered QoS Data frames of r-TWT TID(s), and if there is still remaining time in the current restricted TWT SP, the STA should indicate this information to the AP by either of the following methods:

* Include a BSR in a transmitted MPDU that has necessary information to indicate that the total queue size for the r-TWT UL TID(s) is 0, or the total remaining queue size for the r-TWT UL TID(s) minus the amount of buffer size carried in the PPDU being transmitted is 0;
* Include one or more QoS Null frames and for each TID in r-TWT UL TID(s) indicate zero queue size in the QoS Control field of the transmitted QoS Null frame.

### 37.7.5.2 Power Save operation (#4779, #4780, #5348, #4719)

(#4779, #5348) An r-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 following the rules described in 26.8.3.3 (Rules for TWT scheduled STA) except that

* If there are multiple restricted TWT schedules advertised by the r-TWT scheduling AP, the r-TWT scheduled STA is required to be in the awake state only at the start times of restricted TWT SPs that it is a member of; and
* If the r-TWT scheduled STA is not a member of any broadcast TWT schedules that are not restricted TWT schedules, it is not required to be in the awake state at the start times of such broadcast TWT 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) Data frame exchanges 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 |

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.