**IEEE P802.11
Wireless LANs**

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| CC36 CR for Restricted TWT Setup |
| **Date**: August 12, 2021 |
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 **Abstract**

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

4782, 4432, 5883, 5884, 5885, 4123, 5729, 5349.

r11: 4778, 6408, 6409, 6423

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Added discussion section, updated baseline from P802.11beD1.01 to P802.11beD1.1, added resolution to CIDs 4432, 4589, 5882, 5883, 5884, 5885, 4123, 5729
* Rev 2: Editorial revision based on feedback.
* Rev 3: Further editorial revision based on feedback, changed bTWT agreement to bTWT membership in discussion, added modification text to 9.4.2.199 to correct that Restricted TWT Traffic Info Present subfield is indicated in Broadcast TWT Info subfield and not Request Type field as per P802.11beD1.1.
* Rev 4: Deferred #4589 and improved resolution of #5884 and #4781 based on feedback and offline discussion.
* Rev 5: Deferred #6413 and updated corresponding proposed text in 35.7.2.2 based on feedback.
* Rev 6: Improved resolution of #4778 based on feedback, spec text changed in SC.35.7.2.2 also based on offline feedback.
* Rev 7: Editorial and spec text changes based on feedback and offline discussion.
* Rev 8: Editorial and spec text changes based on offline discussion. Added resolution to CIDs 5349, 5954.
* Rev 9: Deferred CIDs 4781 and 5882
* Rev 10:Defer CIDs 4781 and 6408
* Rev 11: Bring back resolution to CIDs #4778, 6408, 6409, 6423
* Rev 12: Minor editorial changes

***TGbe Editor: Please note, the baseline for this document is P802.11be D1.4 and REVme D1.0***

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** | **Pg/Ln** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 4432 | Arik Klein | 298.32 | 35.6.2.1 | The sentence "If there is any restricted TWT agreement set up, the EHT AP shall announce the restricted TWT service period schedule information..." assumes that restricted TWT agreement has been set up. However, the setup procedure of restricted TWT agreement is not explained either in section 35.6.2 or in section 35.6.3. | Please add description of the Restricted TWT agreement setup procedure. | **Revised**The text already introduced in P802.11beD1.1 SC 35.7.2 (based on 21/462r9) explains the restricted TWT setup procedure. Please also note that SC 35.6 on Restricted TWT in 11beD1.0 is now SC 35.7 in 11beD1.1.  **Note to the Editor:**No further changes are required for the resolution of this CID in this document. Changes are already reflected in P802.11beD1.1. |
| ~~4778~~ | ~~Chunyu Hu~~ | ~~298.23~~ | ~~35.6.2~~ | ~~rTWT can build in support for a peer-to-peer link so the latency sensitive traffic over the peer-to-peer link can also enjoy any applicable benefit of rTWT (e.g. channel access, txop sharing), regardless how the peer-to-peer link sets up some service periods for latency sensitive traffic (softAP/STA, TDLS or other p2p protocol out of 802.11 scope). The current rTWT is lack of such support.~~ | ~~Please add support of rTWT for p2p. For example, dcn 11-21/462r5 defines the <peer-to-peer> field in Fig. 9-689a for the peer-to-peer latency sensitive traffic tx/rx SP to be aware at AP. (The authors removed this field as there wasn't enough time to discuss.)~~~~There might be some details or other aspects (in addition to the setup procedure) to make the rTWT support of P2P to work. Please add.~~ | **~~Revised~~**~~Agreed with the commenter on support for p2p. Peer-to-Peer bit is added to Broadcast TWT Info subfield and other relevant changes are made.~~**~~TGbe editor, please make change as shown in this doc 11-21/1224r8 tagged by 4778.~~** |
| ~~4781~~ | ~~Chunyu Hu~~ | ~~298.58~~ | ~~35.6~~ | ~~Both the TWT request and response setup frames have DL/UL TID indications (in the restricted TWT traffic info field). What is the expected values in response frames? Are the indicated TIDs per request as notification and/or they can be negotiable? Current text (per 11-21/462r9) is not clear about it. Need to add text in 35.7 (Restricted TWT agreement setup) per 11-21/462r9 and any other necessary place to clarify.~~ | ~~As in comment.~~ | **~~Revised~~**~~Agreed with the commenter that there is need to describe the expected values in response frames. Text is revised to add rules regarding DL/UL TID indications in response frames in rTWT setup negotiations.~~**~~TGbe editor, please make change as shown in this doc 11-21/1224r8 tagged by 4781.~~** |
| 4782 | Chunyu Hu | 298.23 | 35.6.2 | In the draft text brought in by 11-21/462r9, the third paragraph (When included in an individually addressed TWT Setup frame ...) describes the setting of the Restricted TWT Traffic Info Present field in individually addressed TWT Setup frame, but misses the setting in frames with Negotiation Type set to 2. 11-21/462r8 had the text but didn't get time for discussion and, the text was removed for progress. But we need to add text to address this. | As commented | **Revised**Added text to specify setting for frames with Negotiation Type 2.**TGbe editor, please make change as shown in this doc 11-21/1224r8 tagged by 6413.** |
| ~~6408~~ | ~~Muhammad Kumail Haider~~ | ~~126.18~~ | ~~9.4.2.199~~ | ~~A PDT and motion(#2920) was passed to make changes to TWT element to accommodate restricted TWT schedule announcements and negotiations. However, the passed version of PDT and motion does not address how the TWT element can be used to signal r-TWT usage for peer-to-peer links of a STA. STAs should be able to use r-TWT operation to provide protection for latency sensitive traffic on their p2p links as well, as it aligns with 802.11be direction to expand support for low-latency traffic and p2p links.~~ | ~~Broadcast TWT parameter set field should have a field/subfield to indicate if the r-TWT schedule is also used by peer-to-peer traffic.~~ | **~~Revised~~**~~Similar comment as 4778. Peer-to-Peer subfield is added to broadcast TWT element.~~**~~TGbe editor, please make change as shown in this doc 11-21/1224r8 tagged by 6408.~~** |
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| ~~5882~~ | ~~Liangxiao Xin~~ | ~~298.34~~ | ~~9.4.2.199~~ | ~~Need extra parameter setting for R-TWT setup, whether there is quiet elment protection, whether R-TWT member STA is allowed to contend channel outside R-TWT SP.~~ | ~~suggest to use all the values of the broadcast TWT recommendation subfield 4~7 for restricted TWT.~~ | **~~Reject.~~** ~~Quiet element protection is decided by AP as per network policy and applied to entire restricted SP which may be shared by multiple STAs, and is not negotiated per STA. Quiet intervals are also announced in separate IE. Whether STA is allowed to contend outside r-TWT SP will be addressed by PS rules for rTWT.~~ |
| 5883 | Liangxiao Xin | 298.34 | 9.4.2.199 | When a non-AP STA requests a membership of R-TWT, it should indicate which SCSs whose traffic will be scheduled to transmit during the SPs of that R-TWT. | add a new field called "All SCS" in Figure 9-689a Broadcast TWT Info subfield format. When it is set to "1", it indicates that the traffic of all the existing SCSs are scheudled to be transmitted during the corresponding R-TWT SPs. If it is set to "0", then the TWT membership exchange frame should indicate which SCSs whose traffic will be transmsitted during the R-TWT SP. | **Reject.** If TIDs of corresponding SCSIDs are included in r-TWT traffic info field, those traffic streams are latency sensitive and can be scheduled during corresponding r-TWT SPs. We do not need to specify All SCS; it is implied. Further, the text already introduced in P802.11beD1.1 SC 9.4.2.199 (based on 21/462r9) specifies that TIDs in r-TWT traffic info field identify latency sensitive traffic, and all SCS mapping to the indicated TID can be transmitted during the corresponding r-TWT SP. An SCS negotiation is only optional for r-TWT operation. |
| 5884 | Liangxiao Xin | 298.34 | 9.4.2.199 | A TID number could be shared by latency sensitive traffic and regular traffic. Therefore, TID is not enough to differentiate latency sensitive traffic from regular traffic. | When the Restricted TWT Traffic Info Present field is set to "1" in Figure 9-689a--Broadcast TWT Info subfield format, the SCS information is better than TID bitmap to indicate the traffic of the latency sensitive traffic. | **Reject.** Similar comment as 5883 above. The group has already passed motion and text is incorporated to P802.11be/D1.1 SC 9.4.2.199 that latency sensitive traffic is identified based on TIDs. This is also consistent with BA operation which is also at TID level. Moreover, STA and AP can make use of the information in SCS to select packets between SCS streams of the same TID if desired, prioritize among multiple TIDs that are allowed within an r-TWT SP etc.  |
| 5885 | Liangxiao Xin | 298.34 | 9.4.2.199 | Since broadcast TWT and restricted TWT use the same signaling, the TWT scheduling AP should not allocate a same TWT ID to a broadcast TWT and a restricted TWT. A legacy STA can regard a restricted TWT as a special broadcast TWT. | same as in the comment | **Revised.**The text already introduced in P802.11beD1.1 SC 9.4.2.199 (based on 21/462r9) specifies signaling for r-TWT using b-TWT as baseline and specifies bTWT/rTWT parameter sets share the same Broadcast TWT ID field in bTWT Info subfield and as such the IDs are drawn from the same pool and are not reassigned. **Note to the Editor:**No further changes are required for the resolution of this CID in this document. Changes are already reflected in P802.11beD1.1. |
| 4123 | Akira Kishida | 298.01 | 35.6.4.2 | If dot11RestrictedTWTOptionImplemented set to true and the value of restricted TWT service period set to 0, it seems that restricted TWT may not be operated but normal Broadcast TWT will be operated. | If dot11RestrictedTWTOptionImplemented is set to true, the range of the value of the restricted TWT service period should be set to more than 1. | **Reject**There is no difference between bTWT and rTWT in terms of setting the SP duration, and rTWT follows baseline spec on Nominal Minimum TWT Wake Duration. Agreed that 0 SP duration is not very meaningful, but we think that discussion could be had in REVme for bTWT behavior in general if there is interest within the group. |
| 5729 | KENGO NAGATA | 298.01 | 35.6.4.2 | If dot11RestrictedTWTOptionImplemented set to true and the value of restricted TWT service period set to 0, it seems that restricted TWT may not be operated but normal Broadcast TWT will be operated. | If dot11RestrictedTWTOptionImplemented is set to true, the range of the value of the restricted TWT service period should be set to more than 1. | **Reject**Same comment as 4123 above. |
| 5954 | Liuming Lu | 298.22 | 35.6.2 | The coordination mechanism between the Restricted TWT agreement setup and TID-to-link mapping negotiation has not been specified. For example, if a restricted TWT scheduled STA is affiliated with an non-AP MLD, a restricted TWT scheduling AP affiliated with an AP MLD shall ensure that DL TIDs and/or UL TIDs indicated in the Broadcast TWT Info subfield of Broadcast TWT Parameter Set field in the Broadcast TWT element of restricted TWT setup frame are mapped to its corresponding link before or during the establishment of a restricted TWT agreement. | Suggest to specify the coordination mechanism or rules between the Restricted TWT agreement setup and TID-to-link mapping negotiation | **Revised**Added text to specify that TIDs indicated in r-TWT agreement setup should be from TIDs mapped to the corresponding link**TGbe editor, please make change as shown in this doc 11-21/1224r8 tagged by 5954.** |
| 5349 | Jarkko Knect | 298.35 | 35.6.3 | Currently a bit signals whether a BC TWT flow is rTWT flow or not. Legacy BC TWT capable STAs may ignore a bit in BC TWT information. This may cause a situation that BC TWT STA wakes up for rTWT SPs, but it will not get any service. This will cause very bad power save for BC TWT STA. | Please ensure backward compatibility for rTWT Flows and make sure that legacy STAs do not confiuse rTWT Flows to be BC TWT flows. For instancem, a seprate signaling element for rTWT Flows and BC TWT flows ensures that legacy STAs cannot confuse the signaling. | **Revised.**The text already introduced in P802.11beD1.1 SC 9.4.2.199 (based on 21/462r9) specifies the rTWT setup procedure has changed to use a recommendation value instead of a bit indication. While agreed, no action is needed.**Note to the Editor:**No further changes are required for the resolution of this CID in this document. Changes are already reflected in P802.11beD1.1. |

**Discussion:**

1. A couple of CIDs relate to clarification of whether TIDs indicated in UL/DL TID Bitmaps in the Traffic Info field during restricted TWT setup negotiations are negotiable. We propose that the TIDs indicated in the TWT Request frame are treated as such, a request, and hence the TWT Response frame shall carry the same TIDs with an appropriate TWT Setup Command, based on whether AP can accept the request or suggest an alternate or reject. However, if either UL and/or DL TIDs are not specified in the Request frame, those could be included in the Response frame. (CID deferred for further discussion.)
2. A related issue is what should be the response if a TWT Request frame indicates TIDs which are not mapped to the corresponding link (in context of TID-to-Link mapping). An EHT STA should not include such TIDs in the TWT Request in the first place. However, if such a request is made, based on above point, we propose that the AP send a TWT Response frame with Reject TWT and indicate the same TIDs as in the Request frame. This simplifies the setup negotiation.
3. Another issue is whether it should be required to indicate some latency sensitive TIDs corresponding to a restricted TWT membership. We propose that such indication should be required, to limit usage of restricted TWT operation for latency sensitive traffic only. As such, we propose that if a restricted TWT membership is setup, the final Response frame with Accept TWT command, which establishes the membership, shall have both UL and DL TID Bitmaps valid, and some TIDs should be specified. Note that there is still the option to indicate all TIDs as latency sensitive, but some indication must be included. Further, we add an exception for the case when rTWT SP is used for p2p traffic.

**9. Frame formats**

**9.4.2.199. TWT element**

***TGbe editor: modify the paragraph 4 at Page 145 of P802.11be D1.1 (The Restricted TWT Traffic Info…) as follows:***

﻿The Restricted TWT Traffic Info field is present in a Restricted TWT Parameter Set field when the

Restricted TWT Traffic Info Present subfield of the ~~Request Type~~ Broadcast TWT Info subfield is set to 1. Its format is defined in

Figure 9-689b (Restricted TWT Traffic Info field format(#2920)). (#4782)

**35.7. Restricted TWT**

**35.7.2.2. The setup procedure**

***TGbe editor: insert the following paragraphs after paragraph 5 at Page 345 of P802.11be D1.1 (When included in an individually addressed…) as follows:***

An r-TWT scheduling AP that includes a Restricted TWT Parameter Set field in a broadcast TWT element shall set the Restricted TWT Traffic Info Present subfield of the Restricted TWT Parameter Set field to 0 if the Negotiation Type subfield of the TWT element is equal to 2. (#4782)

~~An r-TWT scheduling AP that includes Restricted TWT Parameter Set field(s) in a broadcast TWT element carried in a TWT Response frame that indicates Accept TWT shall have the DL TID Bitmap Valid and UL TID Bitmap Valid subfields of the Restricted TWT Traffic Info field in the Restricted TWT Parameter Set(s) set to 1.(#4781)~~ The r-TWT scheduling AP should indicate in the Restricted TWT DL TID Bitmap and Restricted TWT UL TID Bitmap subfields only the TIDs that are mapped to the link on which the restricted TWT membership is being set up (see 35.3.6.1 TID-to-link mapping).(#5954)

The r-TWT scheduled STA should indicate in the Restricted TWT DL TID Bitmap and Restricted TWT UL TID Bitmap subfields only the TIDs that are mapped to the link on which the restricted TWT membership is being set up (see 35.3.6.1 TID-to-link mapping).(#5954)

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| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4778 | Chunyu Hu | 298.23 | 35.6.2 | rTWT can build in support for a peer-to-peer link so the latency sensitive traffic over the peer-to-peer link can also enjoy any applicable benefit of rTWT (e.g. channel access, txop sharing), regardless how the peer-to-peer link sets up some service periods for latency sensitive traffic (softAP/STA, TDLS or other p2p protocol out of 802.11 scope). The current rTWT is lack of such support. | Please add support of rTWT for p2p. For example, dcn 11-21/462r5 defines the <peer-to-peer> field in Fig. 9-689a for the peer-to-peer latency sensitive traffic tx/rx SP to be aware at AP. (The authors removed this field as there wasn't enough time to discuss.)There might be some details or other aspects (in addition to the setup procedure) to make the rTWT support of P2P to work. Please add. | **Revised**Agreed with the commenter on support for p2p. Added Broadcast TWT Recommendation value 5 to indicate p2p, and other relevant spec changes are made.**TGbe editor, please make change as shown in this doc 11-21/1224r12 tagged by 4778.** |
| 6408 | Muhammad Kumail Haider | 126.18 | 9.4.2.199 | A PDT and motion(#2920) was passed to make changes to TWT element to accommodate restricted TWT schedule announcements and negotiations. However, the passed version of PDT and motion does not address how the TWT element can be used to signal r-TWT usage for peer-to-peer links of a STA. STAs should be able to use r-TWT operation to provide protection for latency sensitive traffic on their p2p links as well, as it aligns with 802.11be direction to expand support for low-latency traffic and p2p links. | Broadcast TWT parameter set field should have a field/subfield to indicate if the r-TWT schedule is also used by peer-to-peer traffic. | **Revised**Agreed with the commenter on support for p2p. Added Broadcast TWT Recommendation value 5 to indicate p2p, and other relevant spec changes are made.**TGbe editor, please make change as shown in this doc 11-21/1224r12 tagged by 6408.** |
| 6409 | Muhammad Kumail Haider | 126.18 | 9.4.2.199 | 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, Broadcast TWT Recommendation value of 4 was defined to indicate restricted TWT parameter set. However, from 11axD8.0 9.4.2.199 pg 189, "The Broadcast TWT Recommendation is reserved if transmitted by a TWT scheduled STA." Modify text to accommodate when bTWT recommendation=4 is transmitted by r-TWT scheduled STAs | as in comment | **Revised**Agree in principle. Add text about Broadcast TWT Recommendation value 4**TGbe editor, please make change as shown in this doc 11-21/1224r12 tagged by 6409.** |
| 6423 | Muhammad Kumail Haider | 241.01 | 26.8.3 | 802.11ax text specifies rules for TWT scheduling APs and scheduled STAs. Text should be revised to accommodate rules that apply to r-TWT operation and clarify any exceptions. One such modification is adding behavior for Broadcast TWT Recommendation value 4, which was specified in motion#2920 to indicate restricted TWT parameter set | as in comment | **Revised**Baseline text is modified to add text about Broadcast TWT Recommendation value 4**TGbe editor, please make change as shown in this doc 11-21/1224r12 tagged by 6423.** |

**9. Frame formats**

**9.4.2.199. TWT element**

***TGbe editor: modify last paragraph on Page 1607 of REVmeD1.0 (﻿The TWT Flow Identifier…) as follows:***

﻿The TWT Flow Identifier subfield contains a 3-bit value that identifies the specific information for this TWT request uniquely from other requests made between the same TWT requesting STA and TWT responding STA pair. The Broadcast TWT Recommendation subfield contains a value that indicates recommendations on the types of frames that are transmitted by TWT scheduled STAs and scheduling AP during the broadcast TWT SP, encoded according to the Broadcast TWT Recommendation field for a broadcast TWT element as ﻿defined in Table 9-332 (Broadcast TWT Recommendation field for a broadcast TWT element(11ax)). (#6409, #6423)The Broadcast TWT Recommendation is set to 0, 4 or 5 if transmitted by a restricted TWT scheduled STA, and otherwise is reserved if transmitted by a TWT scheduled STA.(11ax)

***TGbe editor: change Table 9-339 (not all rows shown) and the paragraph below it of P802.11be D1.4 as follows:***

**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** |
| … | … |
| (#2920)4 | The corresponding broadcast TWT SP is referred to as an r-TWT SP.(#4775) During an r-TWT SP, the AP and member r-TWT scheduled STAs prioritize their transmission of QoS Data frames that are latency sensitive traffic (see 35.8 (Restricted TWT (r-TWT))).﻿ |
| 5 | (#4778, #6408) The corresponding broadcast TWT SP is referred to as an r-TWT SP.During an r-TWT SP, the AP and member r-TWT scheduled STAs prioritize their transmission of QoS Data frames that are latency sensitive traffic between them, as well as those between a member r-TWT scheduled STA and its peer STA(s), as described in 35.8 (Restricted TWT (r-TWT)). |
| (#2920) ~~5~~ 6–7 | Reserved |

A broadcast TWT parameter set that has the Broadcast TWT Recommendation field value equal to 4 (#4778, #6408)or 5 is referred to as a restricted TWT parameter set.

***TGbe editor: insert the following new paragraph after the paragraph (The Restricted TWT DL TID Bitmap and Restricted TWT UL TID Bitmap subfields) in P802.11be D1.4, as follows:***

(#4778, #6408)In a restricted TWT parameter set included in a TWT element in a TWT setup frame, if the Broadcast TWT Recommendation field is set to 5 and all bits in the Restricted TWT DL TID Bitmap and Restricted TWT UL TID Bitmap subfields are set to 0, the corresponding r-TWT schedule is intended to prioritize the transmission of QoS Data frames that are latency sensitive traffic between the member r-TWT scheduled STA and its peer STA(s), as described in 35.8 (Restricted TWT (r-TWT)).

**35.8. Restricted TWT (r-TWT)**

**35.8.4 Channel access rules for r-TWT service periods**

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

***TGbe editor: insert the following new paragraph at the end of 35.8.4.1 of P802.11be D1.4, as follows:***

(#4778)During a trigger-enabled r-TWT SP for which the r-TWT scheduled STA sets up its membership with the Broadcast TWT Recommendation field equal to 5, if both the r-TWT scheduling AP and the r-TWT scheduled STA have the Triggered TXOP Sharing Mode 2 Support subfield in EHT Capabilities element set to 1, the r-TWT scheduling AP shall schedule for transmission at least one Trigger frame addressed to the r-TWT scheduled STA that is an MU RTS TXS Trigger frame with the TXOP Sharing Mode subfield equal to 2 (see 35.2.1.3 Triggered TXOP sharing procedure).