IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Restricted TWT Spec Text  Restricted TWT Announcement | | | | |
| Date: 2021-07-19 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Chunyu Hu | Meta Platform Inc. | 1 Hacker Way, Menlo Park, CA 95034 |  | chunyuhu07@gmail.com |
| Muhammad Kumail Haider |  |  |  |
| Chitto Ghosh |  |  |  |
| Morteza Mehrnoush |  |  |  |
| Payam Torab |  |  |  |
| Binita Gupta |  |  |  |
| Liuming Lu | Oppo |  |  |  |
| Brian Hart | Cisco |  |  |  |
| Saju Palayur | MaxLinear |  |  |  |
| Dave Cavalcanti | Intel |  |  |  |
| Laurent Cariou | Intel |  |  |  |
| Arik Klein | Huawei |  |  |  |
| Rubayet Shafin | Samsung |  |  |  |
| Alfred Asterjadhi | Qualcomm |  |  |  |

Abstract

This submission proposes resolutions for the following CIDs (10) for TGbe CC36:

4156, 4433, 4783, 5938, 6412,

6746, 7858, 6948, 6949, 4151

Revisions:

* Rev 0: Initial version of the document
* Rev 1: Remove three CIDs (6415, 7429, 5273) to be addressed later, added discussion, fixed “agreement” (use membership or schedule), addressed some feedback.
* Rev 2: address various comments raised by Brian and Gaurav.
* Rev 3: change the element name to “Restricted TWT SPs”; revise the format of the bitmap; and revises text accordingly.
* Rev 4: address some editorial comments; and change interval to 256 usecs (same as time slice duration unit.)
* Rev 5: Redefine the reserved field in existing Broadcast TWT Info subfield for the new fields allocated for r-TWT purpose, and remove the new “Restricted TWT SPs” element.
* Rev 6: Revised document to modify spec text on top of changes made to 11be D1.4 in 21/1768r7, removed CID 6414 that got resolved in 21/1768r7, added resolution to a related CID #4151.

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 D1.4.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4151 | Alfred Asterjadhi | 9.4.2.199 | 126.18 | Make appropriate amendments to B-TWT IE for the additional r-TWT SPs. | As in comment. | **Revised**  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 4151.** |
| 4156 | Alfred Asterjadhi | 35.6.3 | 298.32 | The correct term is membership rather than agreement. Replace please, and specify what is actually modified in the B-TWT IE in this subclause rather than saying that it is a modified B-TWT IE. Also is the AP required to have a membership already setup before starting to announce these schedules? Can't the AP start advertising and the STAs join them? | As in comment. | **Revised --** replace “agreement” with “membership” or “schedule”.  AP can advertise the r-TWT schedule before any STA joins it per baseline and also as described by the 35.7.2 (Restricted TWT setup). Further, a new field is added to indicate if the schedule is “active”, as the new text proposed in this draft.  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 4156.** |
| 4433 | Arik Klein | 35.6.3 | 298.34 | the sentence refers to "the modified broadcast TWT element " - please clarify what is the format of this element? It is not specified in section 9.4.2.X... | As in comment | **Revised.**  Proposed new field in bTWT element allocation (reuse reserved).  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 4433.** |
| 4783 | Chunyu Hu | 35.6.3 | 298.30 | The TBDs in this subclause per D0.4 was fixed with some brief description as temporary solution in order to move onto D1.0. There is a draft text pending to fix TBDs to solve a few problems: advertise the rTWT schedule only if there are agreement setup, share with the rTWT supporting STAs a consolidated view of rTWT SP schedule so they don't need to parse each rTWT schedule contained in each rTWT parameter set. | Will bring in contribution to solve the original TBDs in D0.4 | **Revised**  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 4783.** |
| 5938 | Li-Hsiang Sun | 35.6.3 | 298.34 | No definition of the "modified broadcast TWT element" | add definition | **Revised.**  Similar response to #4433 etc.  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 5938.** |
| 6412 | M. Kumail Haider | 35.6.3 | 298.30 | 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 such a field may be included in TWT announcements in broadcast frames | Traffic TID specification is part of r-TWT schedule negotiation between AP and STA and it should be allowed for the same r-SP to carry traffic for different TIDs for different member STAs, depending on their own negotiations. As such, traffic Info field should not be included in schedule announcements and the text should specify that TWT schedule announcements in broadcast frames shall not carry traffic info field. | **Revised.**  Agree with commenter. Text proposed in 21/1224 and accepted into 802.11beD1.3 in 35.7.2.2 specifies that TWT announcements (Negotiation Type=2 in TWT element) carried in broadcast frames shall not have r-TWT traffic info subfield.  **TGbe editor, please note that no futher changes are needed for resolution of this CID.** |
| 6746 | Rojan Chitrakar | 35.6.3 | 298.33 | It is not clear what is the "modified broadcast TWT element" referred in this sentence is; 26.8.3 does not specify "modified broadcast TWT element". | Provide a proper reference for "modified broadcast TWT element" | **Revised.**  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 6746.** |
| 7858 | Yonggang Fang | 35.6.3 | 298.34 | Suggest to delete "modified" broadcast TWT ... | See the comment | **Revised.**  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 7858.** |
| 6948 | Saju Palayur | 35.6.4.1 | 298.40 | Normative indicated in section is not aligned with the normative in 26.8.1 that says that " STA does not need to be aware of the values of TWT parameters of the TWT agreements of other STAs in the BSS of the STA or of TWT agreements of STAs in other BSSs. | Please align normative for EHT stations with regards to TWT | **Revised.**  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 6948.** |
| 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 | **Revised.**  Agree in principle. Add text that if AP advertises an active r-TWT schedule of OBSS, the STA follows the same rule.  **TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 6949.** |

**Discussion:**

* As per Broadcast TWT operation defined in baseline, broadcast TWT element is advertised in the following broadcast frames and carries broadcast and/or restricted TWT parameter set field(s) with Negotiation Type 2:
  1. Beacon frames
  2. Broadcast Probe Response frames
  3. FILS Discovery frames

It doesn’t seem necessary to repeat this text/rule in this section.

Based on several comments in CC36, this document adds three indications about r-TWT SPs announced in the TWT element, which can help with more efficient membership negotiations and r-TWT operation. These three indications are as follows:

**Active**: Indicates if a schedule has any members or not and the schedule is not completely suspended now. Baseline bTWT operation in 802.11ax allows AP to advertise schedules even if they don’t have any members. For such schedules, other STAs in BSS need not end their TXOP at start boundary if it can be indicated in the announcement.

There are several use-cases when AP may announce r-TWT schedules without any members yet. AP could devise these schedules based on the current congestion state of network/OBSS etc. and it may have a (strong) preference for when rTWT SPs may be best served. In enterprise networks it could also be based on some previous statistics AP may have learnt or as a policy.

Another scenario is the case when AP is designed to serve specific applications in a vertical e.g., TSN or industrial applications with predictable periodicity. In this case, AP can define and advertise specific bTWT/rTWT schedules for industrial IoT devices to join. Therefore, it is a useful capability but r-TWT supporting STAs should not end their TXOPs at boundary of such schedules unnecessarily.

**Full:** If AP has allocated all or most of time/frequency/spatial resources within an SP and can likely not accommodate more memberships, it can indicate an SP as Full. This can help r-TWT scheduled STAs target for membership such SPs for which AP is more likely to accept a new membership request.

**OBSS:** Could be helpful for sharing r-TWT schedules across multiple BSS to help with managing interference between BSS. Such signaling can be especially useful as we develop r-TWT further.

## 9.4.2 Elements

## 9.4.2.199 TWT element (4151, 4156, 4433, 4783, 5938, 6412, 6746, 7858)

***TGbe editor: Change Figure 9-770 (Broadcast TWT Info subfield format) as follows:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 B2 | B3 B7 | B8                B15 |
|  | Restricted TWT Traffic Info Present | Restricted TWT Schedule Info | Broadcast TWT ID | Broadcast TWT Persistence |
| Bits: | 1 | 2 | 5 | 8 |
| **Figure 9-770---Broadcast TWT Info subfield format (#4151,4156, 4433, 4783, 5983, 6412, 6746)** | | | | | |

TGbe editor: Please replace the first paragraph after Figure 9-770 (Restricted TWT Schedule Full…) with the following text and insert table after the text:

~~Restricted TWT Schedule Full subfield is set to 1 to indicate that the r-TWT scheduling AP is unlikely to accept a request from a STA in the BSS to establish a new membership in the corresponding schedule; it is set to 0 otherwise. This subfield is valid when the corresponding restricted TWT Parameter Set field is carried in a TWT element with Negotiation Type subfield set to 2, and the TWT element is transmitted by an EHT AP with dot11RestrictedTWTOptionImplemented set to true; otherwise, the subfield is reserved. (#6414)~~

(#4151,4156, 4433, 4783, 5983, 6412, 6746)The Restricted TWT Schedule Info subfield is set as described in Table 9-339a (Restricted TWT Schedule Info subfield values) when included in a Restricted TWT Parameter Set field carried in a TWT element with Negotiation Type subfield set to 2, and the TWT element is transmitted by an EHT AP with dot11RestrictedTWTOptionImplemented set to true; otherwise, the subfield is reserved.

**Table 9-339a---Restricted TWT Schedule Info subfield values**

|  |  |
| --- | --- |
| **Restricted TWT Schedule Info subfield value** | **Description when included in a Restricted TWT Parameter Set field** |
| 0 | The corresponding r-TWT schedule doesn’t have any member STA.  Such an r-TWT schedule is referred to as an inactive r-TWT schedule. |
| 1 | The corresponding r-TWT schedule has at least one member STA.  Such an r-TWT schedule is referred as an active r-TWT schedule. |
| 2 | Indicates an active r-TWT schedule for which the r-TWT scheduling AP is unlikely to accept a request from a STA in the BSS to establish a new membership.(#6414)  Such an r-TWT schedule is referred to as a full r-TWT schedule (i.e., the AP might not have sufficient resources within this schedule for accepting new memberships). |
| 3 | Indicates an active r-TWT schedule of a neighboring BSS.(#6949) |

# 35. Extremely High Throughput (EHT) MAC specification

# 35.8 Restricted TWT (r-TWT)

***TGbe editor: replace the following part shown in grey-highlighted text in Subclause 35.8.3 (r-TWT service periods announcement) with the text marked as NEW TEXT, and modify the remaining sentence as follows:***

## 35.8.3 r-TWT service periods announcement

~~If there is any restricted TWT agreement set up, the EHT AP shall announce the restricted TWT service period schedule information in the modified broadcast TWT element contained in transmitted Management frames, which are specified in 26.8.3 (Broadcast TWT operation).~~

~~An r-TWT scheduling AP, while advertising a restricted TWT schedule, shall indicate whether or not the schedule is avail-able for accommodating any new membership. If the Restricted TWT Schedule Full subfield in the Broadcast TWT Info subfield in a Restricted TWT Parameter Set field is set to 1, it indicates that the corresponding restricted TWT schedule is not available for accommodating any new membership; otherwise, it is available for new membership.~~

***TGbe editor: NEW TEXT as follows:***

(#4151, 4156, 4433, 4783, 5938, 6412, 6746, 7858)If there is any active r-TWT schedule, the r-TWT scheduling AP shall announce the r-TWT schedule information by including restricted TWT parameter set field(s) in the broadcast TWT element as specified in 9.4.2.199 (TWT element), contained in transmitted Management frames, which are specified in 26.8.3 (Broadcast TWT operation).

When advertising an r-TWT schedule, the r-TWT scheduling AP shall set the value of Restricted TWT Schedule Info subfield as described in Table 9-339a (Restricted TWT Schedule Info subfield values).

An r-TWT scheduled STA may request membership in an r-TWT schedule advertised by the r-TWT scheduling AP with Restricted TWT Schedule Info subfield set to 0 or 1.

***TGbe editor: end NEW TEXT***

(#4783)A STA should not request to establish membership in an r-TWT schedule advertised by the r-TWT scheduling AP with Restricted TWT Schedule Info subfield set to 2. (#6414)

**35.8.4 ﻿Channel access rules for restricted TWT service periods**

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

***TGbe editor: Please change the first paragraph ﻿(A non-AP EHT STA with…) as follows:***

﻿A non-AP EHT STA with dot11RestrictedTWTOptionImplemented set to true as a TXOP holder shall ensure the TXOP ends before the start time of any (#4783) active r-TWT SPs advertised by the associated AP. The active r-TWT SPs are advertised by the r-TWT scheduling AP as specified in 35.8.3 (r-TWT service periods announcement).(#6948)