IEEE P802.11
Wireless LANs

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| Restricted TWT Spec TextRestricted TWT Announcement |
| Date: 2021-07-19 |
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Abstract

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

4156, 4433, 4783, 5938, 6412,

6414, 6746, 7858, 6948, 6949

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.

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.***

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| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 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 -- r**eplace “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.** |
| 6414 | M. 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). A PDT and motion(#2920) was also passed to make changes to TWT element to accommodate restricted TWT announcements. However, broadcast TWT element does not convey occupancy information of SPs. For example, AP may announce r-SP schedule to invite membership but no STAs have established membership in such a schedule. In that case, EHT STAs supporting r-TWT operation should not have to end their TXOPs prior to such unoccupied SPs. Moreover, r-SP announcement via b-TWT element does not present a consolidated timeline view of future occurrence of r-SPs and r-SP start boundaries to be used by EHT STAs supporting r-TWT operation to end their TXOPs. | Additional signaling should be introduced to indicate r-SP occupancy information and present a consolidated channel-time view of r-SP occurrence and start boundaries | **Revised.****TGbe editor, please make change as shown in this doc 11-21/1147 tagged by 6414.** |
| 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 (4156, 4433, 4783, 5938, 6412, 6414, 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 | ~~Reserved~~Restricted TWT SP Info | Broadcast TWT ID | Broadcast TWT Persistence |
| Bits:  | 1 | 2 | 5 | 8 |
| **Figure 9-770---Broadcast TWT Info subfield format (#4156, 4433, 4783, 5983, 6412, 6414, 6746, 7858)** |

TGbe editor: Insert the following paragraph and table after the first paragraph on page 171 (A Restricted TWT Traffic Info subfield…)

The Restricted TWT SP Info subfield, when included in a Restricted TWT Parameter Set field in a TWT element with Negotiation Type set to 2, is set as described in Table 9-339a (Restricted TWT SP Info subfield values), and otherwise is reserved.

An active restricted TWT schedule or SP refers to a restricted TWT schedule or SP that has at least one r-TWT scheduled STA as member, and that has at least one member STA that hasn’t suspended the corresponding schedule.

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

|  |  |
| --- | --- |
| **Restricted TWT SP Info subfield value** | **Description when included in a Restricted TWT Parameter Set field** |
| 0 | Indicates the restricted TWT schedule is not active. |
| 1 | Indicates the restricted TWT schedule is active.  |
| 2 | Indicates an active restricted TWT schedule and the schedule is full. For such a schedule, the restricted TWT scheduling AP is unlikely to accept a request to setup new membership. |
| 3 (#6949) | Indicates an active restricted TWT schedule setup by EHT STAs in a neighboring BSS. |

# 35. Extremely High Throughput (EHT) MAC specification

# 35.7 Restricted TWT

***TGbe editor: replace the following part shown in grey-highlighted text in Subclause 35.7.3 (Restricted TWT Service Periods announcement) with the text marked as NEW TEXT:***

## ~~35.7.3 Restricted 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).~~

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

## 35.7.3 Announcement (4156, 4433, 4783, 5938, 6412, 6414, 6746, 7858)

If there is any active restricted TWT schedule setup, the r-TWT scheduling AP shall announce the restricted TWT schedule information via a modified 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 a restricted TWT schedule which does not have any member r-TWT scheduled STA, or all of the member r-TWT scheduled STAs have suspended the schedule, the r-TWT scheduling AP shall set the Restricted TWT SP Info subfield of the corresponding Restricted TWT Parameter Set to 0.

When advertising an active restricted TWT schedule, an r-TWT scheduling AP shall set the value of Restricted TWT SP Info subfield of the corresponding restricted TWT parameter set field as follows:

* When advertising a schedule belonging to its own BSS, if the r-TWT scheduling AP is unlikely to accept a new request to establish membership in the corresponding schedule e.g., if all resources in that schedule have already been allocated to existing member r-TWT scheduled STAs, the AP may indicate so by setting the Restricted SP Info subfield to 2. Otherwise, it shall set the Restricted SP Info subfield to 1.
* When advertising a schedule belonging to a neighboring BSS, the r-TWT scheduling AP shall set the Restricted SP Info subfield to 3. (#6949)

NOTE- An r-TWT scheduled STA may still request membership in a restricted TWT schedule advertised in the TWT element with Restricted TWT SP Info subfield set to 2.

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

**35.7.4.1 ﻿General**

***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 of any active restricted TWT service periods if the TXOP is obtained outside of a restricted TWT service period. (#4156) The active restricted TWT SPs are advertised by the r-TWT scheduling AP as specified in 35.7.3 (Announcement).(#6948)