**IEEE P802.11
Wireless LANs**

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| **Delivering QoS Characteristics element with Restricted TWT setup** |
| **Date:** 2021-11-27 |
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**Abstract**

This submission proposes resolutions for two CIDs for TGbe CC36:

4717, 4838

Revisions:

* Rev 0: Initial version of the document
* Rev 1: Added NOTE 2 based on offline feedback received. Some other editorial updates based on offline feedback.

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 P802.11be D1.4.***

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| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4717 | Chittabrata Ghosh | 35.6.3 | 298.32 | A non-AP EHT STA withdot11RestrictedTWTOptionImplemented set to true and SCS Negotiation Support set to false may include TSPEC elements (or TSPEC variant) in the restricted TWT Traffic Info field | Clarify that am EHT STA may not perform SCS procedure prior or post r-TWT agreement setup in the case mentioned in Comment and hence include one or more TSPEC elements in TWT Setup frame | Revised.Agree in principle. Added an option to include QoS Characteristics element(s) in the r-TWT setup frame, to provide QoS parameters for UL and/or DL r-TWT TIDs.TGbe editor, please make change as shown in this doc tagged by 4717. |
| 4838 | Dibakar Das | 35.6.2 | 298.28 | 11be needs to provide a mechanism that allows a STA to signal the traffic characteristics parameters for a flow that's to be delivered within a r-TWT SP. This would allow an EHT AP to differentiate whether a TWT Request is for a new traffic request or for a flow thats already established | Allow signaling s.t. r-TWT Request frames carry SCSID for flows that are expected to be delivered within a r-TWT SP. | RevisedAgree that a mechanism is needed to provide traffic characteristics parameters for a flow that's to be delivered within an r-TWT SP. To address this, added an option to include QoS Characteristics element(s) in the r-TWT setup frame, to provide QoS parameters for UL and/or DL r-TWT TIDs. TGbe editor, please make change as shown in this doc tagged by 4838. |

**Discussion:**

A new QoS Characteristics element as defined in 21/1407 is added in TGbe D1.4 (9.4.2.316 QoS Characteristics element). The new QoS Characteristics element definition specifies QoS parameters for traffic flows per TID. In the current proposal, the QoS Characteristics element can be included in SCS Request and Response frames (35.3.21 Multi-link SCS procedure), specifying QoS parameters for an SCS stream.

As mentioned in CID 4717, it is also desirable to support the option to provide QoS characteristics for low latency traffic transmitted during the r-TWT service period while setting up the r-TWT SP. This can provide following benefits for r-TWT as described below.

* Non-AP STA is not required to perform a separate SCS Req/Resp before setting up r-TWT SP to provide QoS characteristics for low latency traffic. This minimizes overhead for r-TWT setup from two exchanges (SCS then r-TWT setup exchange) to a single r-TWT setup exchange for scenarios when QoS Characteristics can be provided per TID. This is a desirable optimization for initial setup for r-TWT latency sensitive traffic.
* For r-TWT traffic, setting up TCLAS/traffic filters is not always necessary as is done for SCS to map DL traffic to UP/TID. This is because r-TWT traffic is already identified by TIDs indicated during the r-TWT setup. The AP can map DL traffic to TIDs using tools such as DSCP->UP mapping or other implementation specific means. In such cases, SCS exchange with TCLAS for DL is not required for r-TWT traffic. For such cases, STA should have a mechanism to provide QoS characteristics for r-TWT TIDs as part of the rTWT setup, without any TCLAS.

Providing QoS characteristics with r-TWT setup will be useful in scenarios when a non-AP STA can provide QoS characteristics for traffic streams carried over TIDs in r-TWT SP e.g. in cases when a TID carries a single traffic stream. It is assumed that non-AP STA would ideally map traffic streams with quite different QoS characteristics to different TIDs to provide traffic differentiation at the MAC layer. In scenarios, when a non-AP STA does map multiple traffic streams with quite different QoS characteristics to the same TID, it is assumed that STA will use SCS exchange to specify different QoS Characteristics elements for such traffic streams to the AP. Also, if a STA needs to set up TCLAS for identifying DL traffic stream, it uses SCS exchange to provide TCLAS and QoS Characteristics element (if any) for that traffic stream to the AP,

It is assumed that a non-AP STA which implements both SCS and r-TWT setup with QoS Characteristics element, would provide QoS Characteristics element for a specific TID through one mechanism, either in SCS or in r-TWT setup. Thus, when a STA provides a QoS Characteristics element in the r-TWT setup for a given TID, it does not provide QoS Characteristics element for that TID using SCS.

Both CIDs 4717 and 4838 mention about specifying traffic characteristics of flows delivered in r-TWT SPs. To resolve these CIDs, this document proposes following:

* A non-AP STA should be able to optionally include one or more QoS Characteristics element to provide traffic characteristics for the UL and/or DL r-TWT TIDs with the r-TWT setup. The QoS Characteristics element provided for a TID in an r-TWT setup applies to the TID traffic. It is assumed that a STA using this feature would not use the same TID across different r-TWT schedules that it is a member of. As a result, the QoS Characteristics element for a given TID would be provided as part of the r-TWT setup of a single r-TWT schedule. If a STA uses same TID across multiple r-TWT schedules for different traffic streams, then it would use SCS to provide QoS characteristics for those traffic streams.
* Given that the TWT element includes the schedule information for r-TWT SP, the AP may use the min/max service interval parameters received in the QoS Characteristics element as guidance for negotiating the TWT schedule as per AP implementation. Also, the non-AP STA may omit Service Start Time parameter in the QoS Characteristics element(s) included in the TWT request frame, since TWT field provides SP start time.
* The QoS Characteristics element(s) delivered during r-TWT setup is a reference for the EHT AP's scheduling.
* If QoS characteristics change for r-TWT TIDs, the non-AP STA may perform a new TWT setup frame exchange for that r-TWT schedule, to provide latest QoS Characteristics elements for r-TWT TIDs.
* Upon teardown of an r-TWT schedule for an r-TWT scheduled STA, the r-TWT scheduling AP removes all the QoS Characteristics element(s) for r-TWT TIDs provided during the corresponding r-TWT setup.

## 9.6 Action frame format details

### 9.6.24 Unprotected S1G Action frame details

### 9.6.24.8 TWT Setup frame format

TGbe editor: change ‘Table 9-589—TWT Setup frame Action field format’ of REVmeD1.0 as follows:

**Table 9-545—TWT Setup frame Action field format**

|  |  |
| --- | --- |
| Order | Information |
| 1 | Category |
| 2 | Unprotected S1G Action |
| 3 | Dialog Token |
| 4 | (11ax) One or two TWT (9.4.2.199 (TWT element)) |
| 5 | Zero or more QoS Characteristics (9.4.2.316 (QoS Characteristics element)) (#4717, #4838) |

***TGbe editor: insert the following new paragraph at the end of 9.6.24.8 (TWT Setup frame format) of REVmeD1.0 as follows:***

(#4717, #4838) The QoS Characteristics element defined in 9.4.2.316 (QoS Characteristics element), when present, indicates QoS parameters for traffic associated with a specific TID. Zero or more QoS Characteristics elements may be included in the TWT Setup frame for the r-TWT setup as specified in 35.8.2.3 (R-TWT setup with QoS Characteristics element).

TGbe editor: insert new clause 35.8.2.3 after 35.8.2.2 of P802.11be D1.4 as follow:

## 35.8.2.3 R-TWT setup with QoS Characteristics element (#4717, #4838)

An r-TWT scheduled STA may include one or more QoS Characteristics element(s) in the TWT setup frame for a TWT request sent to the r-TWT scheduling AP, to provide QoS characteristics for traffic carried over r-TWT UL and/or DL TIDs indicated in that TWT request.

NOTE 1- A non-AP EHT STA that implements both SCS and r-TWT setup with QoS Characteristics element provides QoS Characteristics element(s) for a specific TID through one mechanism, either in SCS or in r-TWT setup.

NOTE 2: If a non-AP STA maps multiple traffic streams with different QoS characteristics to the same TID, it uses SCS procedure to provide QoS Characteristics elements for the corresponding traffic streams to the AP. If a non-AP STA needs to set up TCLAS for identifying a DL traffic stream, it uses SCS procedure to provide TCLAS and QoS Characteristics element (if any) for that traffic stream to the AP,

An r-TWT scheduling AP may use the Minimum Service Interval and the Maximum Service Interval parameters from the QoS Characteristics element(s) received as part of an r-TWT setup frame as guidance to determine TWT parameters for the corresponding r-TWT schedule. An r-TWT scheduled STA may omit the Service Start Time parameter in the QoS Characteristics element(s) included in the TWT request frame.

The QoS Characteristics element(s) delivered during r-TWT setup is a reference for the EHT AP's scheduling. An r-TWT scheduling AP should use the QoS Characteristics elements(s), if received, for r-TWT TIDs from the latest r-TWT setup for an r-TWT schedule, to meet the QoS characteristics for r-TWT TIDs during that r-TWT schedule. An r-TWT scheduling AP should schedule for transmission downlink QoS data frames for an r-TWT DL TID during an r-TWT SP such that the Delay Bound and Minimum Data Rate parameters indicated in the QoS Characteristics element for that TID with Direction subfield set to downlink are met for downlink QoS Data frames. During a trigger-enabled r-TWT SP, an r-TWT scheduling AP should enable for transmission uplink QoS data frames for an r-TWT UL TID such that the Minimum Data Rate parameter indicated in the QoS Characteristics element for that TID with Direction subfield set to uplink is met for uplink QoS Data frames.

If the QoS characteristics change for one or more r-TWT TIDs corresponding to an r-TWT schedule, the r-TWT scheduled STA may perform a new TWT setup for that r-TWT schedule.

Upon teardown of an r-TWT schedule for an r-TWT scheduled STA, the r-TWT scheduling AP shall remove all the QoS Characteristics element(s) for r-TWT TIDs provided during the corresponding r-TWT setup for that r-TWT scheduled STA.