IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Resolution for CIDs in CC36 | | | | |
| Date: February 11th, 2022 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | Email |
| Rubayet Shafin | Samsung Research America | 6625 Excellence Ave., Plano, TX, 75023 |  | [r.shafin@samsung.com](mailto:r.shafin@samsung.com) |
| Boon Loong Ng |  |  |
| Ahmed Ibrahim |  |  |
| Peshal Nayak |  |  |
| Vishnu Ratnam |  |  |
| Tomoko Adachi | Toshiba |  |  |  |
| Rojan Chitrakar | Panasonic |  |  |  |
| Yousi Lin | Huawei |  |  |  |

Abstract

This submission proposes resolutions for following 8 comment received for TGbe CC36:

* 7 CID: 6879, 6421, 6885, 7868, 5926, 6896, 6420

SP: Do you agree to the resolutions provided in doc 11-22/0254r5 for the following CIDs for inclusion in the latest 11be draft?

6879, 6421, 6885, 7868, 5926, 6896, 6420

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Simplified the signalling reusing the existing bitmap introduced for iTWT. Revised text based on offline feedback.
* Rev 2: Added resolutions for CIDs: 6421, 6885, 7868, 5926, 6896, 6420, 6070
* Rev 3: Based on offline discussion, settled on Option 2 (Control frame-based) for the TDLS-NSTR part, and removed Option 1 (TDLS Action frame based).
* Rev 4: Editorial changes. TSF related sentence revised.
* Rev 5: Typo fixed related to revision number.

***TGbe editor: Please note Baseline is 11be D1.5***

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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 6879 | Rubayet Shafin | 35.6 | 297.57 | 11be includes multi-link operation. However, how restricted TWT will operate on multi-link devices (MLDs) is not clear. In general, mechanism for Broadcast TWT for MLDs need to be defined. | Commenter will present a contribution on this. | **Revised.**  Agree in principle. Necessary text on broadcast TWT operation for MLD is included.  **TGbe editor, please make change as shown in this doc 11-22/0254r5 tagged by #6879.** |

**Discussion:**

Text related to broadcast TWT for multi-link operation is currently missing in the spec and needs to be added. In general, an AP affiliated with an AP MLD and an STA affiliated with a non-AP MLD should be able to negotiate a broadcast TWT schedule over one link between the AP MLD and the non-AP MLD on behalf of multiple links between the same AP MLD and the non-AP MLD. We need the necessary signalling to enable this for broadcast TWT (the procedure for individual TWT has been added in Draft 1.1). The following example can be helpful in illustrating this process and the outcome we strive to realize in this document:



Figure D-1: Example of Broadcast TWT schedule negotiation over a single link for multiple links

In the example of Figure D-1, an AP MLD has three affiliated APs: AP 1 operates on 2.4 GHz band, AP 2 operates on 5 GHz band, and AP 3 operates on 6 GHz band. A non-AP MLD has three affiliated STAs: STA 1 operates on 2.4 GHz band, STA 2 operates on 5 GHz band, and STA 3 operates on 6 GHz band. Three links are set up and enabled between the AP MLD and the non-AP MLD: Link 1 between AP 1 and STA 1; Link 2 between AP 2 and STA 2; Link 3 between AP 3 and STA 3. The AP MLD advertises a broadcast TWT schedules, namely Schedule A, over all three links. Non-AP STA 1 affiliated with the non-AP MLD sends a broadcast TWT element to AP 1 affiliated with the AP MLD. The broadcast TWT element contains a Broadcast TWT Parameter Set field corresponding to Schedule A. Also, the Broadcast TWT Parameter Set field sent by non-AP STA 1 indicates (*note--this signalling needs to be defined*) the three links, Link 1, Link 2, and Link 3, and sets the TWT Setup Command field as Request TWT. Upon receiving the TWT element, AP 1 sends a TWT element to non-AP STA 1 and includes the Broadcast TWT Parameter Set field corresponding to Schedule A. AP 1, in this Broadcast TWT Parameter Set field, also indicates the same three links, Link 1, Link 2, and Link 3, and sets the TWT Setup Command field as Accept TWT. After the successful broadcast TWT negotiation, Schedule A is established over all the three links: Link 1, Link 2, and Link 3.

**Signalling:**

In order to indicate multiple links for individual TWT operation, in 11be draft, a Link ID Bitmap subfield was introduced in the Individual TWT Parameter Set field. The corresponding bitmap presence indicator is placed in the Control field of the TWT element (see Figure D-2 for reference).



Figure D-2: TWT element format

An Individual TWT element contains a single parameter set corresponding to a single TWT agreement (presence of a second parameter set is possible to indicate TWT parameter ranges corresponding to a single TWT agreement). So, placing the Link ID Bitmap Present subfield in the Control field of the TWT element works out for individual TWT since there is a one-to-one mapping between the Link ID Bitmap in the individual TWT parameter set and the related presence indicator in the Control field of the TWT element as shown in Figure D-3.



Figure D-3: Link ID indication for individual TWT

In a broadcast TWT element, however, there can be multiple parameter sets corresponding to different broadcast TWT schedules. In MLO context, each parameter set may be negotiated for a different set of links. Hence, to indicate the presence of the Link ID Bitmap in a broadcast TWT parameter set, the presence indicator needs to be within the corresponding broadcast TWT parameter set. The needed change is shown in yellow in Figure D-4.



Figure D-4: Link ID indication for broadcast TWT

**9. Frame formats**

**9.4.2.199 TWT element**

***TGbe editor: Please Change Figure 9-766 (Broadcast TWT Parameter Set field format) as follows:***



**Figure 9-766: Broadcast TWT Parameter Set field format (#6879)**

***TGbe editor: Please* change the paragraph (The Link ID Bitmap subfield indicates the links…) in Clause 9.4.2.199 as follows:**

The Link ID Bitmap subfield indicates the links to which an individual or broadcast TWT parameter set contained in the TWT element sent by a STA affiliated with an MLD applies. A value of 1 in bit position of the Link ID Bitmap subfield means that the link to which the TWT parameter set in the TWT element sent by a STA affiliated with an MLD applies. A value of 0 in bit position of the Link ID Bitmap subfield means that the link associated with the link ID is not the link to which the TWT parameter set in the TWT element sent by a STA affiliated with an MLD applies (#6879).

***TGbe editor: Please Change Figure 9-768 (Request Type field format in Broadcast TWT Parameter Set field) as follows:***



**Figure 9-768:** **Request Type field format in Broadcast TWT Parameter Set field (#6879)**

***TGbe editor: Please* insert the following paragraph after the paragraph (In a TWT element transmitted by a TWT requesting or TWT scheduled STA, the TWT Wake Interval is equal to…..) in clause 9.4.2.199:**

The Broadcast TWT Link ID Bitmap Present subfield indicates whether or not a Link ID Bitmap subfield is present in the corresponding Broadcast TWT Parameter Set field. The Broadcast TWT Link ID Bitmap Present subfield is set to 1 if the Link ID Bitmap subfield is present in the corresponding Broadcast TWT Parameter Set field; otherwise, it is set to 0. This subfield is set to 0 when the corresponding Broadcast TWT Parameter Set field is carried in a TWT element with Negotiation Type subfield set to 2 (#6879).

**35.7 TWT operation**

***TGbe editor: Please insert the following subclause 35.7.3 (Broadcast TWT operation) under clause 35.7***

**35.7.3 Broadcast TWT operation (#6879)**

A TWT scheduling AP affiliated with an AP MLD and a TWT scheduled STA affiliated with a non-AP MLD, for negotiating membership of a broadcast TWT schedule, shall follow the rules defined in 26.8.3.1 (General), 26.8.3.2 (Rules for TWT scheduling AP), and 26.8.3.3 (Rules for TWT scheduled STA) with the following additional rules:

* The TWT scheduled STA affiliated with the non-AP MLD or the TWT scheduling AP affiliated with the AP MLD, while negotiating for a broadcast TWT schedule, may indicate the link(s) between the AP MLD and the non-AP MLD for which the negotiation is being conducted. The TWT scheduled STA or the TWT scheduling AP transmitting the TWT element may make the link indication in the Link ID Bitmap subfield in the Broadcast TWT Parameter Set field corresponding to the broadcast TWT schedule.
  + If one or more links are indicated in the Link ID Bitmap subfield in the Broadcast TWT Parameter Set field transmitted by a TWT scheduled STA affiliated with the non-AP MLD or a TWT scheduling AP affiliated with the AP MLD, the corresponding broadcast TWT schedule is negotiated on behalf of the STAs affiliated with the same MLD and operating on the indicated links between the AP MLD and the non-AP MLD. The Target Wake Time field in the Broadcast TWT Parameter Set field shall be in reference to the TSF time link on which the broadcast TWT element is transmitted. The target wake time of the intended link is derived by adjusting the TSF offset with respect to the TSF of transmitting link.
* A TWT scheduling AP affiliated with an AP MLD that receives a TWT element with Link ID Bitmap subfield in a Broadcast TWT Parameter Set field from a TWT scheduled STA affiliated with a non-AP MLD may respond by including a Link ID Bitmap subfield in the TWT response that indicates a different set of links as that of the received Link ID Bitmap or the same set of links as that of the received Link ID Bitmap but with different TWT parameters if the TWT Setup Command field in the Request Type field in the corresponding Broadcast TWT Parameter Set field in the response frame is set to Alternate TWT or Dictate TWT. The TWT scheduling AP shall respond with a Link ID Bitmap that indicates the same set of links in the received Link ID Bitmap and the same TWT parameters as that indicated in the received Broadcast TWT Parameter Set field if the TWT Setup Command field in the Request Type field in the corresponding Broadcast TWT Parameter Set field in the response frame is set to Accept TWT or Reject TWT.

If a TWT scheduling AP affiliated with an AP MLD or a TWT scheduled STA affiliated with a non-AP MLD transmits a broadcast TWT element that contains a Link ID Bitmap subfield in at least one of the Broadcast TWT Parameter Set fields included in the TWT element, then the TWT scheduling AP or the TWT scheduled STA shall set the Link ID Bitmap Present subfield in the Control field of the broadcast TWT element to 1. Otherwise, the TWT scheduling AP or the TWT scheduled STA shall set the Link ID Bitmap Present subfield to 0.

The AP MLD or the non-AP MLD shall not transmit a TWT element over any of the links set up between them that includes a TWT parameter set field containing a Link ID Bitmap subfield with -th bit in the bitmap set to 1 if the corresponding -th link is disabled for the non-AP MLD through TID-to-Link mapping.

***TGbe editor: Please add the following subsection 35.8.6 (Restricted TWT with multi-link operation) under clause 35.8***

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

**35.8.6 Restricted TWT with multi-link operation (#6879)**

An r-TWT scheduling AP or an r-TWT scheduled STA, in the context of multi-link operation, for negotiating membership of a restricted TWT schedule, shall follow the rules defined in 35.7.3 (Broadcast TWT operation) with additional rules described in this subclause.

For r-TWT operation between an AP MLD and a non-AP MLD, the AP MLD or the non-AP MLD shall not transmit a TWT element over any of the set up links between them that includes an r-TWT parameter set with the -th bit in the Restricted TWT DL TID Bitmap subfield or Restricted TWT UL TID Bitmap subfield, if present, set to 1 if the TID for the respective direction is not mapped on the intended link for which the restricted TWT schedule is being negotiated. The AP MLD or the non-AP MLD shall not transmit a TWT element over any of the links between them that includes an r-TWT parameter set with the DL TID Bitmap Valid subfield or UL TID Bitmap Valid subfield, if present, to 0 if any of the TIDs is not mapped on the desired link for the respective direction (#6879).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 6421 | Muhammad Kumail Haider | 35.3.15 | 281.17 | The behavior of a non-AP STA in EMLSR mode and its associated AP when there is an r-TWT agreement on one or more enabled links needs to be defined. The rules should ensure the EMLSR STA ends its TX/RX before the r-TWT SP start boundary. | Define channel access rules for EMLSR non-AP STA as TXOP holder and responder to ensure any TXOP ends before r-TWT SP boundary on any link and latency sensitive traffic delivery is prioritized during the r-TWT SP. | Agree in principle. Necessary text for handling the issue has been added.  **TGbe editor, please make change as shown in this doc 11-22/0254r5 tagged by #6885.** |
| 6885 | Rubayet Shafin | 35.3.10.4 | 268.31 | In this page, discussion have been provided for traffic indication for U-APSD. How about for other power management mechanism such as TWT? | Corresponding rules/description should be provided for other power management mechanism including TWT operation. | Agree in principle. Necessary text for handling the issue is has been added.  **TGbe editor, please make change as shown in this doc 11-22/0254r5 tagged by #6885.** |
| 7868 | Yongho Kim | 35.3.15 | 281.17 | A description for a TWT procedure for the eMLSR operation is required. | Add an eMLSR description for a TWT. | Agree in principle. Necessary text for handling the issue has been added.  **TGbe editor, please make change as shown in this doc 11-22/0254r5 tagged by #6885.** |

***TGbe editor: Please insert the following subclause 35.3.17.1 (EMLSR operation with r-TWT) under clause 35.3.17 (Enhanced multi-link single radio operation) (#6885)***

**35.3.17 EMLSR operation with r-TWT*(#6885)***

When a non-AP MLD is operating in EMLSR mode with an AP MLD, and an AP affiliated with the AP MLD and operating on one of the EMLSR links (the first link) between the AP MLD and the non-AP MLD is the TXOP holder on that link, if an r-TWT schedule is established on another EMLSR link (the second link) , or on any link if the non-AP MLD is a single radio device, between the same AP MLD and the non-AP MLD, then the AP affiliated with the AP MLD and operating on the first link should end its TXOP at least an amount of time indicated in the EMLSR Padding Delay subfield in the EML Capabilities subfield of the Basic Multi-Link element before the r-TWT SP starts on the second link.

When a non-AP MLD is operating in EMLSR mode with an AP MLD and a STA affiliated with the non-AP MLD and operating on one of the EMLSR links (the first link) between the AP MLD and the non-AP MLD is the TXOP holder on that link, if an r-TWT schedule is established on another EMLSR link (the second link), or on any link if the non-AP MLD is a single radio device, between the same AP MLD and the non-AP MLD, then the STA affiliated with the non-AP MLD and operating on the first link should end its TXOP at least an amount of time indicated in the EMLSR Padding Delay subfield in the EML Capabilities subfield of the Basic Multi-Link element before the r-TWT SP starts on the second link.

When a non-AP MLD is operating in EMLSR mode with an AP MLD and an r-TWT schedule is established on one of the EMLSR links between the AP MLD and the non-AP MLD, then an AP affiliated with the AP MLD may initiate a frame exchange on that link during the r-TWT SP on that link without transmitting the initial control frame to the r-TWT scheduled STA affiliated with the non-AP MLD and operating on that link.

When a non-AP MLD is operating in EMLSR mode with an AP MLD and multiple r-TWT schedules are established on multiple links between the AP MLD and the non-AP MLD, and if those links are also included in the EMLSR links and if the r-TWT SP on one link overlaps, in time, with the r-TWT SP on another link, then the non-AP MLD, at least a duration of time indicated in the EMLSR Padding Delay subfield before the overlapping r-TWT SP starts on either of the links, shall transmit an RLS Control subfield in a frame to the AP MLD over any enabled link between the AP MLD and the non-AP MLD to indicate the link, between the two links on which the overlapping r-TWT SPs are scheduled, on which the non-AP MLD intends to exchange frames with the AP MLD during the corresponding r-TWT SP on the elected link. The R-TWT Link ID Bitmap subfield in the RLS Control subfield shall indicate the Link ID of the elected link by setting the corresponding bit position in the R-TWT Link ID Bitmap subfield to 1.

***TGbe editor: Please insert the following subclause 9.2.4.7.11 (RLS Control) under clause 9.2.4.7 (Control subfield variants of an A-Control subfield) (#6885)***

**9.2.4.7.11 RLS Control *(#6885)***

The Control Information subfield in an RLS Control subfield contains information on the link ID of the elected link on which the non-AP MLD intends to exchange frames with the AP MLD during the r-TWT SP on the elected link (see 35.3.17 (EMLSR Operation with r-TWT)). The format of the Control Information subfield in an RLS Control subfield is shown in Figure 9-zz1 (Control Information subfield format in an RLS Control subfield).



Figure 9-zz1-- Control Information subfield format in an RLS Control subfield

The R-TWT Link ID Bitmap subfield in the RLS Control subfield indicates the elected link on which the non-AP MLD intends to exchange frames with the AP MLD during the r-TWT SP on that link.

***TGbe editor: Please update Table 9-25 (Control ID subfield values) as follows(#6885)***

**Table 9-25--- Control ID subfield values**

|  |  |  |  |
| --- | --- | --- | --- |
| **Control ID value** | **Meaning** | **Length of the Control Information subfield (bits)** | **Content of the Control Information subfield** |
| 0 | Triggered response scheduling (TRS) | 26 | See 9.2.4.6a.1 (TRS Control) |
| 1 | Operating mode (OM) | 12 | See 9.2.4.6a.2 (OM Control) |
| 2 | HE link adaptation (HLA) | 26 | See 9.2.4.6a.3 (HLA Control) |
| 3 | Buffer status report (BSR) | 26 | See 9.2.4.6a.4 (BSR Control) |
| 4 | UL power headroom (UPH) | 8 | See 9.2.4.6a.5 (UPH Control) |
| 5 | Bandwidth query report (BQR) | 10 | See 9.2.4.6a.6 (BQR Control) |
| 6 | Command and status (CAS) | 8 | See 9.2.4.6a.7 (CAS Control) |
| 7 | EHT operating mode (EHT OM) | 6 | See [9.2.4.7.8 (EHT OM Control)](#bookmark4) |
| 8 | Single response scheduling (SRS) | 10 | See [9.2.4.7.9 (SRS Control)](#bookmark9) |
| 9 | AP assistance request (AAR) | 20 | See [9.2.4.7.10 (AAR Control)](#bookmark11) |
| 10 | R-TWT Link Selection (RLS) | 20 | See [9.2.4.7.11 (RLS Control)](#bookmark11) |
| 11–14 | Reserved |  |  |
| 15 | Ones need expansion surely (ONES) | 26 | Set to all 1s |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 5926 | Li-Hsiang Sun | 35.3.14.3 | 275.34 | If link1 used for TDLS for a non-AP MLD is in a NSTR pair with the link 2 which AP is transmitting to the non-AP MLD, then AP should be able to detect the NAV and TA/RA of the TDLS packet. Otherwise AP should avoid to send on link 2 when link 1 has TDLS avtivities | non-AP MLD operate on a TDLS off-channel should enter PS mode on MLO enabled links that are NSTR to the off-channel  non-AP MLD using TDLS on a link1 which is in a NSTR link pair with a link 2, may enter PS mode on link2 before TDLS exchange on link 1. Otherwise it should use a control frame or a PPDU with preamble carrying its id to start the TDLS txop | Agree in principle. Necessary text for handling the issue is added.  **TGbe editor, please make change as shown in this doc 11-22/0254r5 tagged by #6896.** |
| 6896 | Rubayet Shafin | 35.3.14.3 | 274.60 | Whenever, there is a peer-to-peer link (e.g. TDLS link) between any pair of STAs affiliated with a pair of non-AP MLDs over one link, and if any of the non-AP MLDs is not STR capable over any of the links, the other NSTR link(s) become essentially ineffective. Consider the following scenario that illustrates this situation--Assume that MLD\_S and MLD\_R are two non-AP MLDs and MLD\_A is an AP MLD. STA1 and STA2 are two non-AP STAs affiliated with the non-AP MLD, MLD\_S; STA3 and STA4 are two non-AP STAs affiliated with non-AP MLD, MLD\_R; and AP1 and AP2 are two APs affiliated with AP MLD, MLD\_A. Two links have been set up between MLD\_S and MLD\_A--- one between STA1 and AP1 over Link 1, and the other between STA2 and AP2 over Link 2. Moreover, two links have been set up between MLD\_R and MLD\_A--- one between STA3 and AP1 over Link 1, and the other between STA4 and AP2 over Link 2. STA3 and STA4, operating on Link 1 and Link 2, respectively, form an NSTR link pair. Now, a TDLS link has been established between STA1 and STA3. When STA3 is communicating to STA1 over the TDLS direct link, AP MLD, MLD\_A, usually is not aware of the communication over the TDLS link. MLD\_A is aware of MLD\_R' s NSTR capability; so, without the TDLS link as long as STA3 is not transmitting to AP1 over Link 1, AP2 can perform downlink transmission to STA4 over Link 2. However, over the TDLS direct link, if STA3 is transmitting to STA1, then STA4 would not be able to receive packets from AP2 over Link2. | Spec needs to provide solution/guideline for handling NSTR issue when one or more non-AP STAs, affiliated with a non-AP MLD and forming NSTR link pair(s), establish TDLS direct link with one or more non-AP STAs affiliated with another non-AP MLD. | **Revised.**  Agree in principle. Necessary text for handling the issue is added.  **TGbe editor, please make change as shown in this doc 11-22/0254r5 tagged by #6896.** |

**Discussion:**

Whenever there is a peer-to-peer link (e.g. TDLS link) between any pair of STAs affiliated with a pair of non-AP MLDs over one link, and if any of the non-AP MLDs is not STR capable over any of the links, the other NSTR link(s) become essentially ineffective.

The above problem can be explained with the illustration in Figure D-5. In Figure D-5, and are two non-AP MLDs and is an AP MLD. STA1 and STA2 are two STAs affiliated with STA3 and STA4 are two STAs affiliated with AP1 and AP2 are two APs affiliated with Two links have been set up between and --- one between STA1 and AP1, and the other between STA2 and AP2. Moreover, two links have been set up between and --- one between STA3 and AP1, and the other between STA4 and AP2. STA3 and STA4, operating on Link 1 and Link 2, respectively, form an NSTR link pair. Now, a TDLS direct link has been established between STA1 and STA3. When STA3 is communicating to STA1 over the TDLS direct link, AP MLD, , usually is not aware of the communication over the TDLS link (AP1 may not always monitor the TDLS direct link. In order for the TDLS to be used, “*the AP does not need to be direct-link aware, nor does it have to support the same set of capabilities that are used on the direct link*). is aware of NSTR capability; so, without the TDLS link, as long as STA3 is not transmitting to AP1 over Link 1, AP2 may perform downlink transmission to STA4 over Link 2. However, over the TDLS direct link, if STA3 is transmitting to STA1, then STA4 would not be able to receive the packets from AP2 over Link2.



*Figure D-5: Illustration of problem with NSTR MLD in peer-to-peer communications.*

In another example scenario, referring again to Figure D-5, if STA3 has some pending latency sensitive traffic for its TDLS peer STA, STA1, then needs a mechanism to notify the AP MLD about the impending TDLS transmission by STA3 so that AP2 can terminate any ongoing downlink transmission to STA4 before the transmission starts over the TDLS direct link.

In general, a mechanism is needed to notify the AP MLD about an impending transmission over the TDLS direct link so that the AP MLD can manage its downlink transmission to avoid any NSTR interference to either the non-AP MLD that hosts the transmitting TDLS peer STA and the non-AP MLD that hosts the receiving TDLS peer STA at the other end of the TDLS direct link in the case that the receiving TDLS peer STA is also affiliated with a non-AP MLD with NSTR constraints with the TDLS direct link.

***TGbe editor: Please insert the following subclause under clause 9.3.1 (Control frames)* (#6896)*:***

**9.3.1.26 TDLS Transmission Notification frame format**

The frame format of the TDLS Transmission Notification frame is shown in Figure 9-xx1 (TDLS Transmission Notification frame format).



**Figure 9-xx1: TDLS Transmission Notification frame format**

The Duration field is set to the time until the start of transmission by a TDLS peer STA affiliated with a non-AP MLD over the TDLS direct link if Transmission Start-End Indication subfield is set to 1; otherwise, the duration field is set to the time until the end of an ongoing TDLS frame transmission.

The RA field is set to the MAC address of the intended receiver of the TDLS Transmission Notification frame.

The TA field is set to the MAC address of the transmitter of the TDLS Transmission Notification frame.

The TDLS Transmission Information field format is shown in Figure 9-xx2.



**Figure-xx2: TDLS Transmission Information field format**

The Transmission Start-End Indication subfield indicates whether the TDLS Transmission Notification frame indicates the start or the end of a TDLS frame transmission. If the subfield is set to 1, then the TDLS Transmission Notification frame indicates the start of an impending TDLS transmission by a TDLS peer STA affiliated with a non-AP MLD. If the subfield is set to 0, then the TDLS Transmission Notification frame indicates the end of an ongoing TDLS frame transmission by the STA affiliated with the non-AP MLD.

The Ack Requested subfield is set to 1 if an acknowledgement is requested upon receipt of the TDLS Transmission Notification frame; otherwise, the subfield is set to 0. The acknowledgement to the receipt of a TDLS Transmission Information frame is sent using TDLS Transmission Acknowledgement frame (see 9.3.1.27 (TDLS Transmission Acknowledgement frame format)).

The Link ID subfield indicates the link on which a STA affiliated with a non-AP MLD is operating and is going to start or end its transmission over the TDLS direct link.

The TDLS Link Identifier is set to the MAC address of the TDLS peer STA operating at the other end of the TDLS direct link.

***TGbe editor: Please insert the following subclause under clause 9.3.1 (Control frames)* (#6896)*:***

**9.3.1.27 TDLS Transmission Acknowledgement frame format**

The frame format of the TDLS Transmission Acknowledgement frame is shown in Figure 9-xx3 (TDLS Transmission Acknowledgement frame format).



**Figure-9-xx3: TDLS Transmission Acknowledgement frame format**

The RA field is set to the MAC address of the intended receiver of the TDLS Transmission Acknowledgement frame.

The TA field is set to the MAC address of the transmitter of the TDLS Transmission Acknowledgement frame.

**35.3.21 TDLS procedure in multi-link operation**

***TGbe editor: Please insert the following subclause 35.3.21.3 (TDLS Channel Access) under clause 35.3.21 (TDLS procedure in multi-link operation)* (#6896)**

**35.3.21.3 TDLS Channel Access (#6896)**

If a TDLS peer STA affiliated with a non-AP MLD forms one or more NSTR link pair(s) with other STA(s) affiliated with the same non-AP MLD, then before the TDLS peer STA starts transmitting the first frame within an obtained TXOP over the TDLS direct link, the non-AP MLD, through any enabled link, shall send a TDLS Transmission Notification frame with Transmission Start-End Indication subfield set to 1 to the AP MLD notifying about the impending transmission over the TDLS direct link by the TDLS peer STA operating on the link identified by the Link ID subfield of the TDLS Transmission Notification frame. Upon reception of the TDLS Transmission Notification frame, the AP MLD should send a TDLS Transmission Acknowledgement frame to the non-AP MLD over any enabled link and should end any downlink transmission to any STA affiliated with the non-AP MLD and operating on a link that forms an NSTR link pair with the TDLS link at the non-AP MLD. Upon reception of the TDLS Transmission Acknowledgement frame by the non-AP MLD, the TDLS peer STA affiliated with the non-AP MLD may start transmission over the TDLS direct link.

Once the TDLS peer STA ends its transmission over the TDLS direct link, the non-AP MLD, through any enabled link, shall send a TDLS Transmission Notification frame with Transmission Start-End Indication subfield set to 0 to the AP MLD notifying about the end of the ongoing transmission over the TDLS direct link by the TDLS peer STA operating on the link identified by the Link ID subfield of the TDLS Transmission Notification frame.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 6420 | Muhammad Kumail Haider | 35.3.14.3 | 274.60 | The behavior of an NSTR STA and its associated AP on a link which is NSTR with another link on which the STA has an r-TWT agreement needs to be defined. This behavior should encompass r-TWT SP start boundary and transmissions of NSTR STA within the r-TWT SP. | Define channel access rules for NSTR non-AP STA as TXOP holder and responder on one link which is NSTR with another link on which an r-TWT SP occurs of which the non-AP STA is a member. The defined behavior should encompass r-TWT SP boundary rules and prioritize latency sensitive traffic delivery on the first link during r-TWT SP. | **Revised.**  Agree in principle. Necessary text for handling NSTR issue with r-TWT operation has been added.  **TGbe editor, please make change as shown in this doc 11-22/0254r5 tagged by #6420.** |

***TGbe editor: Please insert the following subclause 35.3.16.10 (Restricted TWT operation) under clause 35.3.16 (Multi-Link channel access)* (#6420)**

**35.3.16.10 Restricted TWT operation**

When a non-trigger enabled r-TWT schedule is established on a link (the first link) between an AP MLD and a non-AP MLD that forms NSTR link pair(s) with another link (the second link) between the same AP MLD and the non-AP MLD, the AP affiliated with the AP-MLD and operating on the second link shall end transmission of any frames on the second link before the restricted TWT SP starts on the first link, and if the frame transmitted on the second link solicits an immediate response, then the AP affiliated with the AP MLD should end the transmission of the frame on the second link at least aSIFSTime duration before the r-TWT SP starts on the first link.

When an r-TWT schedule is established on a link (the first link) between an AP MLD and a non-AP MLD that forms NSTR link pair with another link (the second link) between the same AP MLD and the non-AP MLD and the second link also has another r-TWT schedule established such that the r-TWT SP on the second link overlaps in time with the r-TWT SP on the first link and the r-TWT schedule on the second link has higher priority TIDs negotiated than that of the r-TWT schedule on the first link, then for handling NSTR interference, the r-TWT SP on the second link should be prioritized over the r-TWT SP on the first link such that any kind of adjustment in the PPDU transmission, either through padding the PPDU or through truncation of the TXOP, needs to be made at the PPDU transmission on the first link so that PPDU transmission on the second link remains uninterrupted.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 6070 | Liwen Chu | 35.3.15 | 281.17 | the P2P, TDLS etc. may require that eMLSR operation allows both sides support eMLSR operation. | Change the text to allow such operation. | **Rejected.**  The group has not reached a consensus to extend EMLSR operation between two peer STAs. |