IEEE P802.11
Wireless LANs

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| Comment Resolution on P2P |
| Date: March 11, 2023 |
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 Abstract

This submission proposes resolutions for the following 20 comments received for TGbe Initial SA Ballot:

14 CID:

22110 22138 22140 22117 22118 22132 22133

22134 22137 22129 22130 22136 22139 22135

6 CIDs:

22114 22115 22116 22127 22128 22141

SP: Do you agree to the resolutions provided in doc 11-24/335r3 for the following 6 CIDs for inclusion in the latest 11be draft?

22114 22115 22116 22127 22128 22141

Revisions:

* Rev 0: Initial version.
* Rev 0-2: Minor changes based on the online feedback
* Rev 3: Added resolution for 6 new CIDs.

***TGbe editor: Please note Baseline is 11be D5.0***

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.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 22110 | 589.47 | When a non-AP STA becomes a member of a broadcast (or restricted) TWT schedule, if the non-AP STA also intends to transmit its latency-sensitive traffic to its peer STA within the TWT SP, then there is no good mechanism to set up the corresponding expectation with the peer STA. For instance, peer STA may be in a doze state when the first non-AP STA transmits to it. Setting up a separate PSM (e.g. i-TWT) with the matching parameters as that of the broadcast TWT is not effective since the parameters and scales of the broadcast TWT schedule and that separate PSM won't be matching. Moreover, the maintenance of that P2P PSM would be burdensome since every time the AP changes the parameters of the broadcast TWT schedule, the corresponding changes may need to be made in the P2P PSM mechanism through another negotiation process. The spec should address this issue and add a mechanism to handle it. | as in comment. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
| 22138 | 589.47 | No guidance is provided in the spec on how to enable Triggered TXOP sharing for P2P communication during a broadcast TWT SP of an broadcast TWT scheduled STA. Such procedure would be essential so that the STA can utilize the TXOP during the broadcast TWT SP to coordinate with its peer STA for P2P communication. | Include a mechanism to enable triggered P2P communication during broadcast TWT. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
|  |  |  |  |  |
| 22140 | 584.36 | TDLS peer STAs should be able to use a r-TWT schedule to communicate over the TDLS link. However, the AP-side and STA-side procedures to enable the use of r-TWT for TDLS communication is currently missing in the 11be spec. | Please add text in the spec related to procedures to enable r-TWT operation for TDLS communications. |  |
| 22117 | 589.47 | When a STA affiliated with an MLD has established a broadcast TWT schedule with an AP affiliated with an AP MLD, and the if the STA has established a TDLS direct link with another peer STA, then the TDLS peer STA needs to be aware of the exsitence of the broadcast TWT schedule. Otherwise, it may miss the P2P frame reception. | as in comment. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
| 22118 | 589.47 | When a STA becomes a member of a broadcast TWT schedule, if the STA has P2P link with another peer STA, then there needs to be harmonization between the broadcast TWT operation with the AP and the P2P operation. A procedure to enable such harmonization needs to be provided in the spec. | as in comment. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
| 22132 | 584.36 | Two non-AP MLDs can establish a TDLS link between them. However, how broadcast TWT operation can take place between the two peer TDLS non-AP MLDs is not clear and the corresponding procedure should be added in the spec. | as in comment. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
| 22133 | 584.36 | The use of Broadcast TWT schedule, which is the basis of restricted TWT operation, by two TDLS peers STAs for communication over the TDLS direct link is not defined for TDLS operation. | Plese add text address the issue described in the comment. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
| 22134 | 584.36 | Restricted TWT would be an important feature for TDLS communication. However, the use of Broadcast TWT schedule, which is the basis of restricted TWT operation, by two TDLS peers STAs for communication over the TDLS direct link is not defined for TDLS operation (though individual TWT agreement can be established for the TDLS direct link by the amendmends made in 11ax). | Please provide text to enable the utilization of broadcast/restricted TWT schedule by two TDLS peer STAs. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
| 22137 | 584.36 | The procedure to enable Triggered TXOP sharing for a TDLS peer STA where the TDLS peer STA is operating in broadcas TWT is currently missing and needs to be provided. | Include a mechanism to enable triggered TDLS communication during broadcast TWT. | **Revised**Agree in principle. A mechanism is needed to communicate over a direct link during broadcast TWT SPs and make sure that the peer STA is also aware of this bTWT schedule so that it makes itself available during the SPs. Necessary text is included. **TGbe editor, please make change as shown in this doc 11-24/335r2 tagged by #22110.** |
| 22129 | 584.36 | The current single TDLS link discovery/setup process in the spec is broken for EMLMR devices. For example, when the non-AP MLD in the EMLMR mode is the TDLS initiator and a TDLS responding device is a legacy device, the TDLS discovery response can be sent over a link that is included in the EMLMR links and the EMLMR device is involved in EMLMR frame exchange on another link. The EMLMR device may not have any radio left on the link on which the response frame is sent by the TDLS responder. | Please provide text illustrating the mechanism to handle the issue related to TDLS discovery/setup process with device in EMLMR mode. | **Rejected**The issue with TDLS operation with EMLMR was discussed in the group previously but the group could not reach a consensus. See doc 11-23/1124r3 for prior related discussion. |
| 22130 | 584.36 | The current single TDLS link discovery/setup process in the spec is broken for EMLSR or single radio devices. For example, when the MLD in the EMLSR mode (or a single radio non-AP MLD) is the TDLS initiator and a TDLS responding device is a legacy device, the TDLS discovery response can be sent over a link but the EMLSR device may not be operating on that link when the response frame is sent by the TDLS responder (EMLSR device at that time may have the radio on another link). Note that the response frame is not sent through the AP MLD. | Please provide text illustrating the mechanism to handle the issue related to TDLS discovery/setup process with device in EMLSR mode. | **Rejected**The issue with TDLS operation with EMLSR was discussed in the group previously but the group could not reach a consensus. See doc 11-23/1124r3 for prior related discussion. |
| 22136 | 584.36 | If a non-AP MLD is operating in EMLMR mode, how it is possible for the non-AP MLD to establish a TDLS direct link with another peer non-AP MLD is not clear based on the latest IEEE 802.11be specification. | Please provide text on the procedures to initiate a TDLS link when the non-AP MLD has been in EMLMR mode with its associated AP MLD. | **Rejected**The issue with TDLS operation with EMLMR was previously discussed in the group, but the group could not reach a consensus. See doc 11-23/1124r3 for a prior related discussion. |
| 22139 | 584.36 | While a non-AP MLD is communicating with its associated AP MLD and is operating under the EMLSR mode, how it is possible for the non-AP MLD to establish one or multiple peer-to-peer links with another peer non-AP MLD is not clear based on the latest IEEE 802.11be specification. Also, the P2P setup procedure, while operating in the EMLSR mode, is currently missing in the spec. | Please provide text on the procedures to transition into P2P mode when the non-AP MLD has been in EMLSR mode with its associated AP MLD. | **Rejected**The issue with TDLS operation with EMLSR was discussed in the group previously but the group could not reach a consensus. See doc 11-23/1124r3 for prior related discussion. |
| 22135 | 584.48 | This sentence can be misleading since it can be read as if an EHT non-AP STA can't establish multiple TDLS links. Please clearly state that although 11be does not allow a non-AP MLD to establish more than one TDLS links with another non-AP MLD, the non-AP MLD can set up a second TDLS direct link with a different non-AP MLD. For example, a first non-AP MLD can set up one TDLS direct link with a second non-AP MLD and another TDLS direct link with a third non-AP MLD | as in comment. | **Rejected**The baseline spec does not preclude the suggested behavior of establishing TDLS links with multiple STAs (see see 11.20 (Tunneled Direct Link Setup) for reference) |
| 22114 | 584.38 | There needs to be a mechanism in the spec that would enable a non-AP STA to indicate its associated AP its channel resource requirement for peer-to-peer communication. | Please add the missing procedure to inform the AP about the non-AP STA's P2P requirement. | **Rejected**The issue regarding the lack of a mechanism to solicit TXOP from the AP for P2P communication was discussed in the past but no consensus could be reached. See doc 11-23/1780r3 for prior discussion on this |
| 22115 | 589.47 | An R-TWT or B-TWT scheduled STA affiliated with a non-AP MLD may want to seek TXOP from the AP MLD. However, currently there is no mechanism defined in the spec that would enable the non-AP MLD to explicitly seek the TXOP from the AP MLD and such a mechanism should be added in the spec. | Please provide rules/guidance depicting the behavior of STA and AP in regards with TWT SP termination specific for restricted TWT operation. | **Rejected**The issue regarding the lack of a mechanism to solicit TXOP from the AP for P2P communication was discussed in the past but no consensus could be reached. See doc 11-23/1780r3 for prior discussion on this |
| 22116 | 589.47 | Currently there is no mechanism in the spec that enables to request for TXOP from an AP by a non-AP STA. However, such capability would be essential for efficient operation, especially for P2P communication. | Please provide mechanisms and frameworks for requesting TXOP from the AP or AP MLD by an STA or non-AP MLD and describe AP MLD's behavior upon receiving such request. | **Rejected**The issue regarding the lack of a mechanism to solicit TXOP from the AP for P2P communication was discussed in the past but no consensus could be reached. See doc 11-23/1780r3 for prior discussion on this |
| 22127 | 584.36 | An AP-MLD can intend to enable a setup link that may form an NSTR link pair to the off-channel TDLS direct link, as the AP MLD is not involved in TDLS channel switch and is unaware of the off-channel TDLS direct link. The potential NSTR link pair between the off-channel TDLS direct link and any link that is intended to be enabled in TID-to-link mapping negotiation should be avoided. If TID-to-link mapping negotiation is unsuccessful, default mapping will be applied, which will cause the NSTR link pair or congestion. | Please provide rules/mechanisms related to TDLS channel switch for non-AP MLD with NSTR constraints. | **Rejected**The comment is related to the coexistence issue of TDLS/P2P operation within the MLO framework. The topic was discussed in the past but a consensus could not be reached. Please see doc 11-23/1124r2 for reference. |
| 22128 | 584.36 | When an NSTR non-AP MLD is the TDLS initiator, the TDLS responder can send the TDLS discovery response over a first link (direct link) while the NSTR non-AP MLD is transmitting frames to the AP MLD on a second link, where the first link forms an NSTR link pair with the second link. Accordingly, the NSTR non-AP MLD would not be able to receive the response frame from the TDLS responder. | Please provide text specifying rules for TDLS discovery/setup for the NSTR non-AP MLDs. | **Rejected**The comment is related to the coexistence issue of TDLS/P2P operation within the MLO framework. The topic was discussed in the past but a consensus could not be reached. Please see doc 11-23/1124r2 for reference. |
| 22141 | 584.36 | For the scenario where 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. | **Rejected**The comment is related to the coexistence issue of TDLS/P2P operation within the MLO framework. The topic was discussed in the past but a consensus could not be reached. Please see doc 11-23/1124r2 for reference. |

**Discussion:**

When one of the peer STAs (say STA1) establishes a B-TWT/R-TWT with the AP, the STA (STA1) may also want to deliver its P2P traffic to another STA (say STA2) within the corresponding B-TWT/R-TWT SP. However, STA2 may not be a member of the same B-TWT/R-TWT schedule, and may not be aware of the arrangement between the AP and STA1. Therefore, STA2 may not be in Awake state during that B-TWT/R-TWT SP, which can be an issue. Moreover, this can also lead to missed TXOP as some of the comments pointed out—if the B-TWT/R-TWT is trigger-enabled, the AP can send to STA1 an MU-RTS TXS (Mode-2) for its P2P, but STA2 is not aware of STA1’s expectation to receive the P2P frames.

**Question: “**Why not STA1 and STA2 just establish a P2P schedule with any existing P2P PSM tool with the “Matching” parameters with that of the B-TWT/R-TWT schedule that STA1 has with the AP?”

**Answer:** First of all, “matching” the parameters of two entirely different PS mechanisms (e.g. B-TWT vs TDLS peer PSM) is not easy since they don’t have the same set of parameter fields and units (the scales are also different). The second is the maintenance issue. B-TWT/R-TWT schedule is maintained by the AP; the schedule parameters can change with time. Whenever AP makes changes to that schedule, the peer STA has to make corresponding changes with the P2P PS schedule, which is quite troublesome from an implementation point of view.

xxxxxxxxxxxx END OF DISCUSSION PART xxxxxxxxxxxxxxxx

***TGbe editor: Please insert the following paragraph under subclause 35.3.21.1 (General) (#22110)***

If a TDLS peer STA that is a member of a broadcast TWT schedule intends to transmit frames to another TDLS peer STA over a TDLS direct link during the TWT SP corresponding to the broadcast TWT schedule, then the TDLS peer STA may send a TDLS Broadcast TWT Request frame to the other TDLS peer STA if both of the TDLS peer STAs set the TDLS Broadcast TWT Support field in the Extended Capabilities element they transmit to 1, where the broadcast TWT schedule is identified by the Broadcast TWT ID subfield in the TWT Information Extension element in the TDLS Broadcast TWT Request frame. If the other TDLS peer STA, upon reception of the TDLS Broadcast TWT Request frame, responds by transmitting a TDLS Broadcast TWT Response frame with the status code SUCCESS, then the other TDLS peer STA is expected to be in the Awake state during the TWT SPs corresponding to the broadcast TWT schedule. In the TDLS Broadcast TWT Response frame, the Broadcast TWT ID subfield value in the TWT Information Extension element shall be the same as that in TDLS Broadcast TWT Request frame (#22110).

***TGbe editor: Please insert the following subclause under clause 9.4.2 (Elements) (#22110):***

**9.4.2.xx3 TWT Information Extension element (#22110)**

The TWT Information Extension element contains information related to a TWT schedule. The element is defined in Figure 9-xx6



Figure 9-xx6: TWT Information Extension element format

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General).

The format of the Control field is shown in Figure 9-xx7-A



Figure 9-xx7-A: Control field format

The B-TWT Info Present subfield indicates the presence of the B-TWT Info field in the TWT Information Extension element. The B-TWT Info field is present if the subfield is set to 1; otherwise, it is not present.

The format of the B-TWT Info field in the TWT Information Extension element is shown in Figure 9-xx7-B (B-TWT Info field format)



Figure 9-xx7-B: B-TWT Info field format

The Broadcast TWT ID subfield in the B-TWT Info field identifies a broadcast TWT schedule advertised by the AP.

***TGbe editor: Please append a new row to the Table 9-128 (Element IDs) as follows (#22110):***

**Table 9-128—Element IDs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| : | : | : | : | : |
| TWT Information Extension (see 9.4.2.xx3 (TWT Information Extension element)) | 255  | <ANA> | Yes | No |

***TGbe editor: Please append the below two rows in Table 9-498 (TDLS Action field values) as follows (#22110):***

|  |
| --- |
| * TDLS Action field values
 |
|  Action field value | Meaning |
| : | : |
| 11 | TDLS Broadcast TWT Request |
| 12 | TDLS Broadcast TWT Response |
| 13–255 | Reserved |

***TGbe editor: Please insert the following subclause (9.6.12.xx1 TDLS Broadcast TWT Request Action field format) including the Table (Table 9-xx2—Information for TDLS Broadcast TWT Request Action field) under clause 9.6.12 (TDLS Action field formats) (#22110)*:**

**9.6.12.xx1 TDLS Broadcast TWT Request Action field format (#22110)**

The TDLS Broadcast TWT Request Action field contains information shown in Table 9-xx2 (Information for TDLS Broadcast TWT Request Action field).

|  |
| --- |
| Table 9-xx2: Information for TDLS Broadcast TWT Request Action field |
| Order | Information | Notes |
| 1 | Category | The Category field is defined in 9.4.1.11 (Action field) |
| 2 | TDLS Action | The TDLS Action field is defined in 9.6.12.1 (TDLS Action field). |
| 3 | Dialog Token | The Dialog Token field contains a value that is unique among TDLS Broadcast TWT Request Action fields for which a corresponding TDLS Broadcast TWT Response Action field has not been received. The dialog token is specified in 9.4.1.12 (Dialog Token field). |
| 4 | Link Identifier | The Link Identifier element is specified in 9.4.2.60 (Link Identifier element). |
| 5 | TWT Information Extension | The TWT Information Extension element is specified in 9.4.2.xx3 (TWT Extension Information element). |

***TGbe editor: Please insert the following subclause (9.6.12.xx4 TDLS Broadcast TWT Response Action field format) including the Table (Table 9-xx5—Information for TDLS Broadcast TWT Response Action field) under clause 9.6.12 (TDLS Action field formats) (#22110)*:**

**9.6.12.xx4 TDLS Broadcast TWT Response Action field format**

The TDLS Broadcast TWT Response Action field contains information shown in Table 9-xx5 (Information for TDLS Broadcast TWT Response Action field).

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| --- |
| Table 9-xx5: Information for TDLS Broadcast TWT Response Action field |
| Order | Information | Notes |
| 1 | Category | The Category field is defined in 9.4.1.11 (Action field) |
| 2 | TDLS Action | The TDLS Action field is defined in 9.6.12.1 (TDLS Action field). |
| 3 | Dialog Token | The Dialog Token field is set to a value contained in the corresponding TDLS Broadcast TWT Request Action field. The dialog token is specified in 9.4.1.12 (Dialog Token field). |
| 4 | Status Code | The Status Code is specified in 9.4.1.9 (Status Code field) |
| 5 | Link Identifier | The Link Identifier element is specified in 9.4.2.60 (Link Identifier element). |
| 6 | TWT Information Extension | The TWT Information Extension element is specified in 9.4.2.xx3 (TWT Information Extension element). |

***TGbe editor: Please add a new row to Table 9-190 (Extended Capabilities field) as follows (#22110)***

**Table 9-190—Extended Capabilities field *(continued)***

|  |  |  |
| --- | --- | --- |
| **Bit** | **Information** | **Notes** |
| … |  |  |
| <ANA> | TDLS Broadcast TWT Support | The STA sets the TDLS Broadcast TWT Support field to 1 when the STA sets the Broadcast TWT Support field in the HE Capabilities element it transmits to 1 and the STA supports TDLS operation with broadcast TWT as specified in 35.3.21.1 (General). |