IEEE P802.11
Wireless LANs

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| LB266 CR for subclause 35.8.2 |
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Abstract

This submission proposes resolutions of comments received from TGbe comment collection LB266 based on TGbe D2.0.

12820 11877 13837 13870 11878 12821 13442 13871 13834 10050 13223 10395 13299 11881 13826 10051 (16 CIDs)

Revisions:

* Rev 0: Initial version of the document.

***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.***

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| **CID** | **Commenter** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Submission** |
| 12820 | Laurent Cariou | 35.8.2 | 509.48 | It seems that these changes on TWT operation belong to Multi-link operation. As such, this subclause should be moved to subclause 35.3 and probably to the Multi-link Power management subclause 35.3.12 | Move the subclause to 35.3.12.x | Revised-Agree with the comment in principle. Move this subclause to subclause 35.3 Multi-link operation. Apply the changes marked as #12820 in this document |
| 11877 | Alfred Asterjadhi | 35.8.2 | 509.49 | This subclause seems to be exclusively applicable to MLDs. Either remove this subclause to be under MLD operation or simply add "between STAs affiliated with an MLD" at the end of the title. | As in comment. | Revised-Agree with the comment in principle. Move this subclause to subclause 35.3 Multi-link operation. Apply the changes marked as #11877 in this document |
| 13837 | Sanghyun Kim | 35.8.2 | 509.48 | The TWT negotiation procedure should be considered as an MLD-level operation, it is because a non-AP STA operating on a link cannot make judgment(accept, reject, etc.) on behalf of the another STA. | Please define the negotiation procedure for the individually TWT agreements between the MLDs as MLD-level operation, and provide a way identifying each individual TWT agreement established between the MLDs. | Revised-Agree with the comment in principle. Move this subclause to subclause 35.3 Multi-link operation. Apply the changes marked as #13837 in this document |
| 13870 | Ming Gan | 35.8.2 | 509.61 | TWT negotiation for MLD should be MLD level, please update the the text | please update the text | Revised-Agree with the comment in principle. Move this subclause to subclause 35.3 Multi-link operation. Apply the changes marked as #13837 in this document |
| 11878 | Alfred Asterjadhi | 35.8.2 | 509.52 | baseline negotiation applies to the same link. So add "operating on the same link" after "with another MLD. | As in comment. | Revised-Agree with the comment in principle. Apply the changes marked as #11878 in this document |
| 12821 | Laurent Cariou | 35.8.2 | 509.63 | As we've defined a may to negotiate a TWT agreement on one link A through frame exchanges on another link B, we should also allow the joint negotiation of TWT agreements with overlapping SPs on mutliple links (particularly useful for eMLSR non-AP MLDs or dual radio non-AP MLDs) and allow the negotiation of TWT agreements with non-overlapping SPs on multiple links (particularly useful for single radio non-AP MLDs that have the constraint of not being able to operate at the same time on both links). | Define such joint TWT negotiation. Note that we need to be careful on the reference link of the timing parameters for the TWT elements when there are multiple links that are being negotiated | Revised-Agree with the comment in principle. Aligned TWT SP on mutliple links is not only important for eMLSR/eMLMR, but also import for NSTR. Add a procedure for negotiating multiple TWT agreements using a single TWT element. Apply the changes marked as #12821 in this document |
| 13442 | Liwen Chu | 35.8.2 | 509.48 | the subclause allows the TWT agreement establishing for "link(s)" through one TWT Request. The TWT Wake Start Time should be clarified since differernt link(s) may have different TSF time values. Otherwise please change "link(s)" to "link" through the subcaluse and also do the related change in management frame transmission subclause since that subclause assumes that the TWT agreement of multiple links can be done through single TWT negotiation . | As in comment. | Revised-Agree with the comment in principle. Add a procedure for negotiating multiple TWT agreements using a single TWT element and clarification on TSF part. Apply the changes marked as #13834 in this document |
| 13871 | Ming Gan | 35.8.2 | 509.61 | The case of multi-link indicated by one TWT element is missing | please complete the missing case | Revised-Agree with the comment in principle. Add a procedure for negotiating multiple TWT agreements using a single TWT element. Apply the changes marked as #13871 in this document |
| 13834 | Sanghyun Kim | 35.8.2 | 509.48 | It is missing how an MLD negotiate the TWT agreement for the multiple links using a single TWT element. | Please define a procedure negotiating multiple TWT agreements using a single TWT element. | Revised-Agree with the comment in principle. Add a procedure for negotiating multiple TWT agreements using a single TWT element. Apply the changes marked as #13834 in this document |
| 10050 | Morteza Mehrnoush | 35.8.2 | 509.59 | Add "s" to STA in "... behalf of the STAs affiliated with the same MLD ..." | as in comment | Rejected-This bullet is for TWT setup on single link, so it is singular. |
| 13223 | Binita Gupta | 35.8.2 | 510.09 | Text "The TWT parameters provided by each TWT element shall be applied and be in reference to the respective link that is indicated in the TWT element." needs to clarify that the TWT parameters from each TWT element is applied to setup TWT agreement on that link. | Modify the said sentence to "TheTWT parameters provided by each TWT element shall be applied in reference to the respective link indicated by the Link ID Bitmap in that TWT element to setup TWT agreement on that link." | Accepted- |
| 10395 | Mengshi Hu | 35.8.2 | 510.24 | To be consistent, "link3" should be "link 3". A space is needed there. | Change "link3" into "link 3" | Accepted- |
| 13299 | Binita Gupta | 35.8.2 | 510.35 | Sentence reads incoherent. Modify current text "These three TWT elements indicate the links of AP 1, AP 2, and AP 3 requesting three links to be setup TWT agreements, respectively, " to new text "These three TWT elements indicate the links of AP 1, AP 2, and AP 3 respectively, requesting three TWT agreements to be setup on three links," | As in comment | Revised-Agree with the comment in principle. Apply the changes marked as #13299 in this document |
| 11881 | Alfred Asterjadhi | 35.8.2 | 510.37 | I think TWT field is present in a twt request only in demand and suggest twt (not request twt). Double check if this is the case and amend accordingly (chose demand or suggest rather than request for the example). | As in comment. | Revised-Agree with the comment in principle. In the spec, it says "If transmitted by a TWT requesting STA or a TWT scheduled STA and the TWT Setup Commandsubfield contains the value corresponding to the command “Request TWT”, the Target Wake Time fieldcontains the value 0". Apply the changes marked as #11881 in this document |
| 13826 | Yuchen Guo | 35.8.2 | 510.42 | "SPs" should be "Agreements" | Replace "SPs" with "Agreements". | Rejected-it is TWT SPs with different parameters, such as their starting time.  |
| 10051 | Morteza Mehrnoush | 35.8.2 | 510.48 | Add "indicates" to this part "element that indicates Link 3 ..." | as in comment | Accepted- |

***TGbe Editor: please modify the following paragraphs in subcClause 35.8 as follows:***

 35.3.26 TWT operation (#12820, 11877,13837, 13870)

35.3.26.1 **General (#12820,** 11877,**13837, 13870)**

 35.3.26.2 Individual TWT agreements (#12820, 11877,13837, 13870)

An MLD may negotiate individual TWT agreements with a peer MLD as defined in 10.47.1 (TWT overview) and 26.8.2 (Individual TWT agreements) via an enabled link (#11878) except the following: (#12820, 11877, 13837, 13870)

* A TWT requesting STA affiliated with the MLD may indicate the link(s) that are requested for setting up TWT agreement(s) in the Link ID Bitmap subfield, if present, of a TWT element in the TWT request.(#12820, 13837, 13870)
* If only one link is indicated in the Link ID Bitmap subfield of the TWT element, then a single TWT agreement is requested on behalf of the STA affiliated with the same MLD and that is operating on the indicated link. The Target Wake Time field of the TWT element shall be in reference to the TSF time of the link indicated by the TWT element.
* If multiple links are indicated in the Link ID Bitmap subfield of the TWT element, then multiple TWT agreements are requested to be setup; A TWT agreement is requested on behalf of each of the STAs affiliated with the same MLD and that is operating on each of the indicated links.
	+ The same TWT parameters are requested for all the indicated links.
	+ The target wake time of i-th link indicated in the Link ID Bitmap subfield (TWT\_i) is derived from the Target Wake Time field of the TWT element as follows: TWT\_i = TWT\_ti + TSF\_offset, where TWT\_ti obtained from the the Target Wake Time field of the TWT element is in reference to the TSF time of i-th link indicated in the Link ID Bitmap subfield of the TWT element, TSF\_offset = (TSF\_0 - TSF\_i) and TSF\_0 is the TSF time of the setup link that is associated link ID of the lowest value, where the TSF\_i is the TSF time of the i-th link indicated in the Link ID Bitmap subfield of the TWT element. (#12821, 13442, 13871, 13834)
* A TWT responding STA affiliated with a peer MLD that receives a TWT request that contains a Link ID Bitmap subfield in a TWT element shall respond with a TWT response that indicates the link(s) in the Link ID Bitmap field of a TWT element. The link(s), if present, in the TWT element carried in the TWT response, shall be the same as the link(s) indicated in the TWT element of the soliciting TWT request. (#12820, 11877, 13837, 13870)

NOTE-The individual TWT agreement is negotiated between the STAs affiliated with the MLDs that are operating on an enabled link and is not negotiated between two MLDs. (#12820, 11877, 13837, 13870)

During the negotiation of individual TWT agreements, a TWT requesting STA affiliated with an MLD and a TWT responding STA affiliated with a peer MLD may include multiple TWT elements where each of the Link ID Bitmap subfields in each TWT element indicates different link(s) in the same TWT Setup frame. The TWT parameters provided by each TWT element shall be applied in reference to the respective link that is indicated by the Link ID Bitmap in that TWT element to setup TWT agreement on that link. (#13223)

An example of TWT agreements negotiated for multiple links is shown in Figure 35-32 (Example of TWT agreements negotiation across multiple links).



(#10395)

Figure 35-32 – Example of TWT agreements negotiation across multiple links

In this example, 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. Non-AP STA 1 affiliated with the non-AP MLD sends three TWT elements in a TWT request to AP 1 affiliated with the AP MLD. These three TWT elements indicate the links of AP 1, AP 2, and AP 3 respectively, requesting three TWT agreements to be setup on three links, and they (#13299) have different TWT parameters, such as target wake up time, and all are with a value of Demand (#11881) TWT in the TWT Setup Command field. AP 1 sends three TWT elements in a TWT response to non-AP STA 1 and these three TWT elements indicate the links of AP 1, AP 2, and AP 3 respectively; and they are all with a value of Accept TWT in the TWT Setup Command field. After successful TWT agreements setup on the three links, three TWT SPs with different TWT parameters exist on these three links (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3), respectively. For these three TWT agreements, the Target Wake Time field of the TWT element that indicates link 1 is in reference to the TSF time of link 1, the Target Wake Time field of the TWT element that indicates link 2 is in reference to the TSF time of link 2 and the Target Wake Time field of the TWT element that indicates (#10051) link 3 is in reference to the TSF time of link 3.

In another example with the same configuration, non-AP STA 1 affiliated with the non-AP MLD sends a TWT element in a TWT request to AP 1 affiliated with the AP MLD. The TWT element indicates the links of AP 1, AP 2, and AP 3 requesting three links on which to setup TWT agreements (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3), and carries a value of Demand TWT in the TWT Setup Command field. Moreover, the TWT element indicates a Target Wake Time value of T1 and Nominal Minimum TWT Wake Duration of T. AP 1 sends a TWT element in a TWT response to non-AP STA 1 and the TWT element sent by AP 1 confirms the links of AP 1, AP 2, and AP 3 with a value of Accept TWT in the TWT Setup Command field. After successful TWT agrements setup on three links, three TWT SPs with same TWT parameters exist on these three links (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3), respectively. For these three TWT agreements, the Target Wake Time field of the TWT element that indicates link 1, link 2 and link 3 is in reference to the TSF time of link 1, link 2 and link 3, respectively. The target wake time of i-th link indicated in the Link ID Bitmap subfield (TWT\_i) is derived from the Target Wake Time field of the TWT element as follows: TWT\_i = TWT\_ti + TSF\_offset, where TWT\_ti obtained from the the Target Wake Time field of the TWT element is in reference to the TSF time of i-th link indicated in the Link ID Bitmap subfield of the TWT element, TSF\_offset = (TSF\_0 - TSF\_i) and TSF\_0 is the TSF time of the link 1, where the TSF\_i is the TSF time of the i-th link indicated in the Link ID Bitmap subfield of the TWT element, i=1,2,3. As per subclause 35.3.1 (General), an AP MLD or an NSTR mobile AP MLD shall correct the clock drift to be within ±30 μs between TSF timers of any two APs affiliated with the AP MLD. In this case, the starting time of these TWT SPs on three links is almost aligned. An example of how these TWT SPs on the three links occur in time is shown in Figure 35-x (Example of negotiated TWT SPs in the time domain). (#12821, 13442, 13871, 13834)



Figure 35-x – Example of negotiated TWT SPs in the time domain

(#12821, 13442, 13871, 13834)