IEEE P802.11  
Wireless LANs

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| LB266 CR for CID 10861 | | | | |
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Abstract

This submission propose resolution for the following CID for TGbe LB266:

10861

Revisions:

* Rev 0: Initial version of the document
* Rev 1: Changes based on some feedback received.
* Rev 2: Changes based on some offline comments.

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 D2.0.***

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| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 10861 | x.y | 0.0 | When an AP MLD transmits to a non-AP MLD on one NSTR link pair that belongs to the NSTR link pairs for that non-AP MLD, the AP MLD needs to do PPDU end time alignment. But on the non-AP MLD's side, when it receives a PPDU from its associated AP MLD on a link that is a member of one or more NSTR link pairs, it may need to be awake on all links that construct NSTR link pairs with the link where the PPDU is transmitted until the reception of the PPDU is finished, in case that the AP MLD sends other PPDUs on those links. This may result in a waste of power for non-AP MLD. Also, the implementation of end time alignment is complex. May need a simplified operation mode for NSTR operations that can save more power for non-AP MLD and also reduce the implementation complexity for AP MLD. | the commenter will bring a contribution to resolve it. | Revised  Agree in principle. Propose an NSTR power save mode for the AP MLD.  **Instruction to the editor**, ***please make the following changes with the CID tag 10861(doc.: IEEE 802.11-22/1292r2).*** |

**Discussion:**

In the current specification, the mechanism of end time alignment is specified to reduce the chances of the occurrence of STAs affiliated with the same MLD in NSTR link pairs interfering with each other. However, such a mechanism is complex since it has many different cases and conditions which require different rules, and has strict requirements regarding implementations such as μs-level time alignment. Hence, to avoid the complicated end time alignment without reducing downlink medium access opportunities, we proposed a simplified operation mode, named NSTR power save mode, for the AP MLD and non-AP MLDs operating on any NSTR link pairs of those non-AP MLDs. We do not consider an NSTR mobile AP MLD in this case.

This NSTR power save mode is a mode for an AP MLD. The key idea is, when operating on an NSTR link pair of the associated non-AP MLD, the AP MLD only initiates a frame exchange sequence with the non-AP MLD on one of the links of the NSTR link pair at a time, in this way the interference among STAs affiliated with the non-AP MLD is avoided. This mode can also help the non-AP MLD save power.

For an AP MLD in the NSTR power save mode, it can still contend for channel access on an NSTR link pair at the same time, as long as it does not transmit to the same non-AP MLD on both links simultaneously. For example, the AP MLD can simultaneously transmit to two different non-AP MLDs on an NSTR link pair that belongs to one (or two) of the two non-AP MLDs. Hence, the downlink access opportunity is not affected with the NSTR power save mode.

For a non-AP MLD that is associated with the AP MLD in the NSTR power save mode, when the associated AP MLD initiates frame exchanges with it on one link of its NSTR link pair, it may enter a doze state on another link of that NSTR link pair, so that it can save more power. Hence, this mode, though enabled at the AP MLD side, can also be regarded as a frame exchange sequence level power save scheme for non-AP MLDs that have NSTR link pairs.

The key idea can also be applied at the non-AP MLD side, but since the non-AP MLD can determine by itself, whether to contend for channel access on both links of its NSTR link pair when doing uplink transmissions, no signalling is needed.

**Proposed Text Change:**

**1. Proposed Text Change for “35.3.16.4 Nonsimultaneous transmit and receive (NSTR) operation”**

**TGbe editor**: ***at P454 of IEEE P802.11be™/D2.0,*** ***please make the followin***g ***changes in 35.3.16.4 Nonsimultaneous transmit and receive (NSTR) operation*** (CID 10861)

NOTE 1—The STA might not do so if it is not aware of the TSF of the other link.

An AP MLD shall set the NSTR Power Save subfield in the MLD Capabilities and Operations subfield in a frame that it transmits to 1, if it supports the NSTR power save mode. An AP MLD with the NSTR power save subfield in the MLD Capabilities and Operations subfield equal to 1 shall not simultaneously perform frame exchanges with an associated non-AP MLD on any NSTR link pair that belongs to that non-AP MLD. When an AP affiliated with the AP MLD that sets the NSTR power save subfield in the MLD Capabilities and Operations subfield to 1 initiates frame exchanges with a STA affiliated with the non-AP MLD on the first link of an NSTR link pair for the non-AP MLD, another STA affiliated with the same non-AP MLD on the second link of that NSTR link pair, if it is in awake state, may enter the doze state and shall be in awake state when any of the following conditions is met and this is defined as the end of frame exchanges on the first link of that NSTR link pair:

* The MAC of the STA affiliated with the non-AP MLD with which the AP MLD initiates the frame exchanges on the first link of the NSTR link pair does not receive a PHY-RXSTART.indication primitive during a timeout interval of aSIFSTime + aSlotTime + aRxPHYStartDelay starting at the end of the PPDU transmitted by the STA of the non-AP MLD as a response to the most recently received frame from the AP affiliated with the AP MLD or starting at the end of the reception of the PPDU containing a frame for the STA from the AP affiliated with the AP MLD that does not require immediate acknowledgement.
* The MAC of the STA affiliated with the non-AP MLD with which the AP MLD initiates the frame exchanges on the first link of the NSTR link pair receives a PHY-RXSTART.indication primitive during a timeout interval of aSIFSTime + aSlot-Time + aRxPHYStartDelay starting at the end of the PPDU transmitted by the STA of the non-AP MLD as a response to the most recently received frame from the AP affiliated with the AP MLD or starting at the end of the reception of the PPDU containing a frame for the STA from the AP affiliated with the AP MLD that does not require immediate acknowledgement and the STA affiliated with the non-AP MLD does not detect, within the PPDU corresponding to the PHY-RXSTART.indication any of the following frames:
  + an individually addressed frame with the RA equal to the MAC address of the STA affili-ated with the non-AP MLD
  + a Trigger frame that has one of the User Info fields addressed to the STA affiliated with the non-AP MLD
  + a CTS-to-self frame with the RA equal to the MAC address of the AP affiliated with the AP MLD
  + a Multi-STA BlockAck frame that has one of the Per AID TID Info fields addressed to the STA affiliated with the non-AP MLD
  + a NDP Announcement frame that has one of the STA Info fields addressed to the STA affiliated with the non-AP MLD
* The STA affiliated with the non-AP MLD with which the AP MLD initiates the frame exchanges on the first link of the NSTR link pair does not respond to the most recently received frame from the AP affiliated with the AP MLD that requires immediate response after a SIFS.

~~NOTE 2—When initiating the frame exchanges with a non-AP MLD on the first link of the NSTR link~~ ~~pair, the AP MLD might initiate the frame exchanges with another non-AP MLD on the second link of that NSTR link pair.~~

**2. Proposed Text Change for “35.3.16.5 PPDU end time alignment”**

**TGbe editor**: ***at P455 of IEEE P802.11be™/D2.0,*** ***please make the followin***g ***changes in 35.3.16.5 PPDU end time alignment*** (CID 10861)

When an AP MLD with the NSTR Power Save subfield in MLD Capabilities and Operations subfield equal to 0, simultaneously transmits to the STAs of a non-AP MLD operating on a pair of NSTR links for that MLD and at least one of the PPDUs carries a frame that is soliciting an immediate response, then

* The AP shall align the end time of the PPDUs soliciting an immediate response, per the rules defined in this subclause, except if the PPDU carries a high priority frame.

When an AP MLD with the NSTR Power Save subfield in MLD Capabilities and Operations subfield equal to 0, is required to align the end time of simultaneously transmitted PPDUs, it shall satisfy the following conditions:

* The AP MLD shall ensure that the difference between the end times of simultaneously transmitted PPDUs is less than or equal to 8μs (see NOTE 2), where the end time of the PPDU is the time of the end of the last OFDM symbol or the time of the end of the packet extension if present, whichever is later.
* The AP MLD shall ensure that the end time of one or more PPDUs that carries a frame soliciting an immediate response frame, is at most 4μs (see NOTE 3) earlier than the end time of any of PPDUs containing a Trigger frame with the CS Required subfield equal to 1.

**3. Proposed Text Change for “9.4.2.312.2.2 Common Info field of the Basic Multi-Link element”**

**TGbe editor**: ***at P219 of IEEE P802.11be™/D2.0,*** ***please make the followin***g ***changes in 9.4.2.312.2.2 Common Info field of the Basic Multi-Link element*** (CID 10861)

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|  | Maximum Number of Simultaneous Links | SRS Support | TID-To-Link Mapping Negotiation Supported | Frequency Separation For STR/AP MLD Type Indication | AAR Support | NSTR Power Save | Reserved |
| Bits: | 4 | 1 | 2 | 5 | 1 | 1 | 2 |

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| --- | --- | --- |
| Subfield | Definition | Encoding |
| NSTR Power Save | An AP MLD indicates support for NSTR power save mode (See see 35.3.16.4 (Nonsimultaneous transmit and receive (NSTR) operation)) on NSTR link pairs that belong to the associated non-AP MLDs. | For AP MLD:  Set to 1 if the AP MLD supports NSTR power save mode.  Set to 0 otherwise.  Reserved for a non-AP MLD.  See 35.3.16.4 (Nonsimultaneous transmit and receive (NSTR) operation). |