IEEE P802.11
Wireless LANs

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| CR for 35.3.16.4 NSTR operation |
| Date: 2023-04-25 |
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Abstract

This submission proposes comment resolution(s) for the following 16 CID(s) received in LB271 on TGbe D3.1

CIDs:

15099, 15126, 15127, 15875, 16280, 16301, 16314, 16315, 16876, 16877, 16878, 16879, 16880, 17875, 18207, 16211

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: update resolution of CID 15875 and 16879

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause**  | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 15099 | Pei Zhou | 35.3.16.4 | 554.46 | "A non-AP STA affiliated with ... may choose not to transmit any frame corresponding to that AC due to expected interference caused by the transmission at the non-AP STA operating on the other link of the NSTR link pair within the non-AP MLD ...". There is no enough solution how the NSTR situation is avoided. AP's restriction/behavior may also be needed. For example, if NSTR non-AP MLD 1 and NSTR non-AP MLD 2 perform P2P transmission under triggered TXOP sharing mode 2, the AP MLD (and/or other non-AP MLDs) cannot transmit to non-AP MLD 1 and/or non-AP MLD 2. So, other devices should know the ongoing NSTR P2P transmission, in order to avoid the interference to the NSTR link pair. | An non-AP MLD may need to report its peer non-AP MLD's ID to AP MLD (and/or other non-AP MLDs). Then, rules should be provided to avoid AP MLD (and/or other non-AP MLDs) tranmitting to other afflicated STAs of the two non-AP MLDs in P2P transmission. | RejectedThe issue mentioned by the commenter is not only happens under TXS procedure, but also happens at any other time when there is a transmission between two NSTR P2P peers. There are several issues for a non-AP MLD to report its peer non-AP MLD’s ID to AP 1. It will significantly increase the signaling overhead, because it is a TXOP level based signaling.
2. The AP MLD may not know the P2P peer when the P2P link is not established through TDLS

A simply way to handle this issue is that the NSTR P2P peers manages the NSTR link pair through power save mechanisms. When a NSTR P2P peer intend to do the frame exchange through a P2P link, it switchs the non-AP STA on another link of the NSTR link pair to power save mode. |
| 15126 | Tomoko Adachi | 35.3.16.4 | 554.38 | "... due to lack of availability of an alternative frame in the queue that would not introduce the opportunity for such interference." Is "the opportunity" required? Can't it be just "... due to lack of availability of an alternative frame in the queue that would not introduce such interference."? | As in comment. | RejectedThis sentence was discussed in doc 11-21/1259r5 (CID 4217), in which “cause such interference” was replaced with “introduce the opportunity for such interference”. Considering that there is no big difference between both expressions, and the word “opportunity” can positively imply that the alternative frame may target a different STA, it is better to keep the current version. |
| 15127 | Tomoko Adachi | 35.3.16.4 | 554.43 | "... that is enabled by an AP that is the TXOP holder to use a portion of the obtained TXOP through the rules for Triggered TXOP sharing in 35.2.1.2 (Triggered TXOP sharing procedure)may choose not to transmit any frame corresponding to that AC due to expected interference caused by the transmission at the non-AP STA operating on the other link of the NSTR link pair within the non-AP MLD and due to lack of availability of an alternative frame in the queue that would not introduce the opportunity for such interference." Similar comment to the one on the previous paragraph, but some further editorial suggestions. | Change it to read "... that is enabled by an AP that is a TXOP holder to use a portion of the obtained TXOP through the rules for Triggered TXOP sharing in 35.2.1.2 (Triggered TXOP sharing procedure) may choose not to transmit any frame corresponding to that AC due to expected interference caused by the transmission at the non-AP STA operating on the other link of the NSTR link pair within the non-AP MLD and due to lack of availability of an alternative frame in the queue that would not introduce such interference." | Revised“the TXOP holder” is replaced with “a TXOP holder”**TGbe editor, please make changes as shown in 11-23/0706r0 tagged 15127** |
| 15875 | Chunyu Hu | 35.3.16.4 | 555.13 | The NOTE is really unnecessary, plus it's not a good reason as the TSF of the other AP(s) can be learned from the Beacon/Probe Response frames already. | Remove the note. | Rejected The comment fails to identify a technical issue that needs to be resolved. There are many practical scenarios wherein the non-AP MLD may end up not having the TSF values for all link at all times. |
| 16280 | Ryuichi Hirata | 35.3.16.4 | 554.30 | The ability to perform STR might be changed by BW, Tx Power, etc., but TGbe spec does not define how MLD recognizes the ability change to perform STR. | Solve this issue by defining mechanism for MLD to measure the ability change to perform STR. | Rejected This topic has been discussed (See doc 11-22/1745r1). The task group failed to reach consensus on a suitable comment resolution that will satisfy the commentor. The NSTR status depends on different PPDU transmission parameters (such as BW, power, MCS,…) |
| 16301 | Juseong Moon | 35.3.16.4 | 554.31 | The current specification for NSTR updates lacks flexibility in both NSTR operation and NSTR capability updating methods. To address this issue, the deployment of robust MCS, and signaling methods with A-control or action frames could enhance the flexibility of NSTR operation. For instance, a non-AP STA can select its preferred MCS and inform it to the AP MLD for dynamic NSTR operation. Additionally, the AP MLD can send downlink data to the non-AP STA using the same or more robust parameters that the non-AP STA indicated. Moreover, the non-AP STA can modify the NSTR link pair in a single frame or using A-control signaling in uplink frame. | As in comment. | Rejected This topic has been discussed (See doc 11-22/1745r1). The task group failed to reach consensus on a suitable comment resolution that will satisfy the commenter. The NSTR status depends on different PPDU transmission parameters (such as BW, power, MCS,…) |
| 16314 | Juseong Moon | 35.3.16.4 | 554.58 | In an AP MLD, which is associated with STA MLDs operating on an NSTR link pair, while backoff counter is zero and queue is being considered empty, another frame, destined to other STA not causing NSTR interference, can be queued and the EDCA queue becomes non-empty again. In this case, the data frame can be transmitted immediately without invoking new backoff because the backoff counter is already 0. Because this is the AP MLD's operation, it can enhance efficiency of AP MLD's transmission. However, draft 3.0 requires to invoke new backoff procedure for the AP MLD. It is more efficient to transmit a frame which doesn't cause interference without backoff, for the AP MLD. | Please clarify the case to transmit a frame immediately to other STA upon a frame arrival while backoff counter is zero and queue is being considered empty in an AP MLD. | RejectedThe spec text in IEEE 802.11be D1.0 was same as suggested by the commenter which the non-AP MLD invokes a backoff only when the medium is busy. But there is an issue in some cases. For example, an AP affiliated with an AP MLD thransmit to two non-AP STAs which affiliated with two NSTR non-AP MLDs on link 1 through a DL MU PPDU, the two non-AP STAs affilicated with the two NSTR non-AP MLDs on link 2 will consider the TX queue as non-empty at the same. The collision will happen if the medium is idle for both of them. In order to solve this issue, a backoff will be invoked reguardless of the state of medium.More details can be found in CR of CID 6958 in doc 11-21/1259r3 |
| 16315 | Juseong Moon | 35.3.16.4 | 554.61 | "other link of a NSTR link pair" is not correct. | Please change as: "other link of an NSTR link pair" | AcceptedNote to the commenter: All the instances of “a NSTR” have been replaced with “an NSTR” in the resolution of CID 16247**Note to TGbe editor: no further change is needed.** |
| 16876 | Mark RISON | 35.3.16.4 | 554.31 | Needs some kind of intro rather than burying "of an NSTR link pair half-way through" | As it says in the comment | Rejected.The definition of an NSTR link pair can be found in subclause 3.2. The first paragraph of subclause 35.3.16.4 explains that an NSTR link pair is caused by interference from one transmission on one link to the other link. Doesn’t see an issue here. |
| 16877 | Mark RISON | 35.3.16.4 | 554.44 | "Triggered TXOP sharing" should be "triggered TXOP sharing" | As it says in the comment | Revised **TGbe editor, please replace “Triggered TXOP sharing” with “triggered TXOP sharing” in two instances in P560L33 and P479L58 of IEEE802.11be D3.1****P560L33:** …to use a portion of the obtained TXOP through the rules for Triggered TXOP sharing in 35.2.1.2 (Triggered TXOP sharing procedure)…**P479L58:** The Triggered TXOP sharing procedure allows an AP to allocate a portion of an obtained TXOP to one associated non-AP EHT STA for transmitting one or more non-TB PPDUs. |
| 16878 | Mark RISON | 35.3.16.4 | 554.45 | "procedure)may" should be "procedure) may" | As it says in the comment | Accepted |
| 16879 | Mark RISON | 35.3.16.4 | 554.54 | Is that really a "may"? Can the STA do anything else? | Change "may" to "shall perform one of the following actions" | RejectedSome members have concern to use word shall, they want to leave flexibility for potential different behavior base on implementation. |
| 16880 | Mark RISON | 35.3.16.4 | 554.59 | "transmission at the STA operating on the other link" -- it is not clear whether this is interference caused at a same-device STA or at a STA at the peer MLD | Clarify which interference the STA needs to consider | RevisedClarify it is the non-AP STA.Similar clarification is added in the first paragraph of subclause 35.3.16.4**TGbe editor, please make changes as shown in 11-23/0706r0 tagged 16880** |
| 17875 | Gaurang Naik | 35.3.16.4 | 555.01 | A non-AP MLD is not required to receive all group addressed frames and may elect to not receive them. This recommendation suggests that the AP MLD must avoid soliciting frames from the non-AP MLD whenever the response overlaps with the group addressed frames. In addition to adding complexity at the AP, this recommendation may result in poor performance for the non-AP MLD. Instead, the non-AP MLD should be allowed to not respond to the soliciting frame if it intends to receive group addressed frame, similar to EMLSR non-AP MLDs. | As in comment | Rejected.The word “should not” doesn’t force an AP MLD to avoid a soliciting frame from the non-AP MLD. How an AP affiliated with an AP MLD, decides to solicit a non-AP STA on a link of an NSTR link pair is an implementation issue. |
| 18207 | Rubayet Shafin | 35.3.16.4 | 554.30 | In the current spec, the NSTR capability information exchange with the AP MLD is pretty much on a long term basis. However, a device's NSTR ability can change more dynamically. For example, for a folding device, the device can be in STR when in unfolded position, while it is NSTR-constrained when in folded position. The current mechanism in the spec on NSTR information exchange is not conducive to more dynamic NSTR update. | Please provide procedures in the spec to enable dynamic NSTR update. | Rejected This topic has been discussed (See doc 11-22/1745r1). The task group failed to reach consensus on a suitable comment resolution that will satisfy the commentor. The NSTR status depends on different PPDU transmission parameters (such as BW, power, MCS,…) |
| 16211 | Ming Gan | 35.3.16.2 | 554.32 | non-AP MLD may be awake on both links of an NSTR link pair when it is receiving on one link, even though the AP MLD may not send a PPDU on the other link. This is not good for STA power save. | as in comment | RevisedAn NSTR Power Save bit is introduced in MLD Capabilities And Operations subfield of Basic ML element. An AP MLD that set this bit to 1 will only do frame exchange with a non-AP MLD on one link of a NSTR link pair. When frame change happens on one link of the NSTR link pair, the non-AP STA that affiliated with this non-AP MLD on another link of this NSTR link pair can do power save. An AP MLD will set this bit to 0 if it intends to do frame exchange with a non-AP MLD on both links of a NSTR link pair.**TGbe editor, please make changes as shown in 11-23/0706r0 tagged 16211** |

**Discussion for CID 16211：**

In implementation of NSTR, a non-AP MLD may choose not to do PPDU alignment for multiple reasons:

1. Greatly reduce the complexity;
2. In a low traffic rate scenario, not so necessary to bonding two NSTR link to get a higher throughput. When only one link (could be any one link) is used to transmit/ receive frame at any time, the other link could do power save.

An AP MLD may also choose not to do PPDU alignment to reduce the complexity.

Without PPDU alignment, an AP MLD or non-AP MLD still can reduce the latency through multiple NSTR links. Because the link finishes the backoff first will be used to do the transmission.

For simplicity, we can call NSTR without PPDU alignment as simplified NSTR.

If a non-AP MLD intends to operate in simplified NSTR mode, it is better let AP know it. When a non-AP MLD operats in simplified NSTR mode, if AP MLD transmit frame to this non-AP MLD in simplified mode through one link, the AP MLD will not transmit DL frame to this non-AP MLD in another NSTR link. In such case, when this non-AP MLD receive a frame in one NSTR link (first link), the other NSTR link can enter doze state until the frame exchange on first link finished.

In this resolution, one bit is added for non-AP MLD to info its associated AP MLD whether the non-AP MLD is operating on simplified NSTR mode.

**Proposed spec text**

***TGbe editor: Please make the following changes in subclause 35.3.16.4 (Nonsimultaneous transmit and receive (NSTR) operation):***

**35.3.16.4 Nonsimultaneous transmit and receive (NSTR) operation**

An AP affiliated with an AP MLD that has gained the right to initiate the transmission of a frame, of a specific AC, on a link through the rules for EDCA backoff in 10.23.2.4 (Obtaining an EDCA TXOP) may choose not to transmit any frame corresponding to that AC due to the expected interference caused by the transmission at the non-AP (#16880) STA operating on the other link of an NSTR link pair that the link belongs to, within the intended recipient non-AP MLD and due to lack of availability of an alternative frame in the queue that would not introduce the opportunity for such interference.

A non-AP STA affiliated with a non-AP MLD operating on a link of an NSTR link pair that has gained the right to initiate the transmission of a frame. of a specific AC, on a link through the rules for EDCA backoff in 10.23.2.4 (Obtaining an EDCA TXOP) or that is enabled by an AP that is a (#15127) TXOP holder to use a portion of the obtained TXOP through the rules for triggered (#16877) TXOP sharing in 35.2.1.2 (Triggered TXOP sharing procedure) (#16878) may choose not to transmit any frame corresponding to that AC due to expected interference caused by the transmission at the non-AP STA operating on the other link of the NSTR link pair within the non-AP MLD and due to lack of availability of an alternative frame in the queue that would not introduce the opportunity for such interference.

An AP or non-AP STA affiliated with an MLD that has gained the right to initiate the transmission of a frame as described in 10.23.2.4 (Obtaining an EDCA TXOP) for a specific AC, but does not transmit any frames corresponding to that AC for the reasons stated above shall perform one of the following actions (#16879):

—invoke a backoff for the EDCAF associated with that AC, as allowed per h) of 10.23.2.2 (EDCA backoff procedure)

—consider the transmit queue for that AC, as empty, until any frame exists in the queue which if transmitted, the transmitter determines, will not cause an unacceptable level of interference caused by transmission at the non-AP (#16880) STA operating on the other link of (#16247)an NSTR link pair that the AP or non-AP STA belongs to. The queue is then considered to have become nonempty and backoff is invoked per the procedure described in a) of 10.23.2.2 (EDCA backoff procedure), regardless of whether the medium is busy or not.

An AP affiliated with an AP MLD should not transmit a frame that solicits an immediate response to a non-AP STA that is affiliated with a non-AP MLD, on a link that is a member of one or more NSTR link pairs for that non-AP MLD, if the immediate response is expected to overlap in time with group addressed MPDUs scheduled on a link that is a member of any of those NSTR link pairs and any of the other non-AP STA(s) affiliated with the non-AP MLD is expected to be receiving those group addressed MPDUs.

If a non-AP STA that is affiliated with a non-AP MLD, successfully obtains a TXOP on one link of one of its NSTR link pairs before the TBTT of the other link, then it should end its TXOP before the other link TBTT if the other non-AP STA affiliated with the same non-AP MLD, intends to receive the Beacon frame scheduled at that TBTT on that link.

 (#15875)

(#16211) An AP that is affliated with 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 its dot11NSTRPowerSaveImplemented is true; otherwise the AP shall set it to 0.

A non-AP MLD may notify the updated NSTR power save mode to its associated AP MLD, from which the NSTR Power Save subfield in the MLD Capabilities and Operation subfield set to 1 is received, by transmitting an NSTR Power Save Request frame through one of its enabled links. Otherwise, the non-AP MLD shall not send an NSTR Power Save Request frame.

An AP affiliated with an AP MLD shall not transmit an NSTR Power Save Request frame.

An AP MLD that received an NSTR Power Save Request frame shall response with an NSTR Power Save Response frame. The Status Code subfield of the NSTR Power Save Response frame shall set to 0 (SUCCESS).

The non-AP MLD shall not update its NSTR power save mode indicated in NSTR Power Save Control field of the corresponding NSTR Power Save Request frame until the NSTR Power Save Response frame is received.

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 in NSTR power save mode on any NSTR link pair that belongs to that non-AP MLD. When an AP affiliated with the AP MLD initiates frame exchanges with a non-AP STA affiliated with the non-AP MLD in NSTR power save mode on one link of an NSTR link pair for the non-AP MLD, the non-AP STA affiliated with the same non-AP MLD on another link of that NSTR link pair, if it is in awake state, may enter doze state and shall be in awake state at the end of frame exchange sequence as descripted in subclause 35.3.18 (Enhanced multi-link multi-radio operation).

***TGbe editor: Please make the following changes in subclause 9.4.2.312.2.3 (Common Info field of the Basic Multi-Link element): (#16211)***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 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 |

**Figure 9-1002k—MLD Capabilities And Operations subfield format**

**Table 9-401i—Subfields of the MLD Capabilities And Operations subfield**

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| NSTR Power Save | An AP MLD indicates support for NSTR power save mode 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). |

***TGbe editor: Please make the following changes in subclause 9.6.35.1 (Protected EHT Action field): (#16211)***

**Table 9-623c—Protected EHT Action field values**

|  |  |  |
| --- | --- | --- |
| Value | Meaning | Time Priority |
| 0 |

|  |
| --- |
| ID-To-Link Mapping Request |

 | No |
| 1 |

|  |
| --- |
| TID-To-Link Mapping Response |

 | No |
| 2 |

|  |
| --- |
| TID-To-Link Mapping Teardown |

 | No |
| 3 |

|  |
| --- |
| EPCS Priority Access Enable Request |

 | No |
| 4 |

|  |
| --- |
| EPCS Priority Access Enable Response |

 | No |
| 5 |

|  |
| --- |
| EPCS Priority Access Teardown |

 | No |
| 6 |

|  |
| --- |
| EML Operating Mode Notification |

 | No |
| 7 |

|  |
| --- |
| Link Recommendation |

 | No |
| 8 |

|  |
| --- |
| Multi-Link Operation Update Request  |

 | No |
| 9 |

|  |
| --- |
| Multi-Link Operation Update Response  |

 | No |
| 10 | NSTR Power Save Request | No |
| 11 | NSTR Power Save Reponse | No |
| 12-255 |  |  |

***TGbe editor: Please insert following subclauses after subclause 9.6.35.11 (Multi-Link Operation Update Resonse frame): (#16211)***

**9.6.35.12 NSTR Power Save Request frame format**

The NSTR Power Save Request frame is sent by a STA affiliated with a non-AP MLD to request to update its NSTR Power Save mode specified in the NSTR Power Save Control field. The Action field of the NSTR Power Save Request frame contains the information is shown in Table 9-623l (NSTR Power Save Request frame Action field format).

**Table 9-623d—NSTR Power Save Request frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | Protected EHT Action |
| 3 | Dialog Token |
| 4 | NSTR Power Save Control (see 9.4.1.77(NSTR Power Save Control field)) |

The Category field is defined in 9.4.1.11 (Action field).

The Protected EHT Action field is defined in 9.6.35.1 (Protected EHT Action field).

The Dialog Token field is defined in 9.4.1.12 (Dialog Token field) and set by the requesting MLD.

NSTR Power Save Control field is defined in 9.4.1.77(NSTR Power Save Control field) to indicate the updated status of NSTR power save mode.

**9.6.35.13 NSTR Power Save Response frame format**

The NSTR Power Save Response frame is sent by an AP affiliated with an AP MLD in response to a NSTR Power Save Request frame to accept the request of NSTR power save status update in the NSTR Power Save Request frame. The Action field of the NSTR Power Save Response frame contains the information shown in Table 9-623m (NSTR Power Save Response frame Action field format).

**Table 9-623e—NSTR Power Save Response frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | Protected EHT Action |
| 3 | Dialog Token |
| 4 | Status Code |

The Category field is defined in 9.4.1.11 (Action field).

The Protected EHT Action field is defined in 9.6.35.1 (Protected EHT Action field).

The Dialog Token field value is copied from the Dialog Token field in the corresponding NSTR Power Save Request frame.

The Status Code is defined in 9.4.1.9 (Status Code field).

***TGbe editor: Please insert following subclause after subclause 9.4.1.76 (EMLSR Parameter Update field): (#16211)***

**9.4.1.77 NSTR Power Save Control field**

The NSTR Power Save field is defined in Figure 9-144n (NSTR Power Save Control field format).

|  |  |  |
| --- | --- | --- |
|  | B0 | B1 B7 |
|  | NSTR Power Save Mode | Reserved |
| Bits: | 1 | 7 |

**Figure 9-144n—NSTR Power Save Control field format**

A non-AP MLD sets the NSTR Power Save Mode subfield to 1 to indicate that the NSTR power save mode is enabled for the non-AP MLD and to 0 to indicate that the NSTR power save mode is disabled for the non-AP MLD.