IEEE P802.11
Wireless LANs

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| CC36 Resolution for miscellaneous CIDs |
| Date: January 14, 2022 |
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 Abstract

This submission proposes resolutions for following 20 CIDs received for TGbe CC36:

4047, 5076, 5914, 5978, 6751, 6198, 7456, 6981, 4025, 7893, 6011, 5336 (Non-AP MLD behavior during discovery and FILS Discovery)

5451, 8048, 6324, 4421, 7467, 8356, 4699, 6069 (EMLSR)

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: Added resolutions for CID 6981
* Rev 2: Added resolutions for additional CIDs
* Rev 3: Fixed the document revision in the resolution column
* Rev 4: Revised resolutions for deferred CIDs 6198, 7456, 4025, 7893, 6324, 4421 based on offline feedback

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.***

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| **CID** | **Commenter** | **Section** | **Pg.Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 4047 | Abhishek Patil | 35.3.4.3 | 253.53 | An AP MLD can use the Neighbor Report element and the procedures similar to the ones described in clause 11.21.7 to help perform load balancing between it affiliated APs. | Commenter will provide a contribution | **Revised**Agree with the commenter. The changes corresponding to the comment have already been proposed and approved in document 11-21/1710r5 as a resolution for CID 5322. No technical changes are required for the resolution of this comment. A reference to the subclause added in doc 11-21/1710r5 is added.**TGbe editor: Please implement the changes shown in document 11-21/2027r3 tagged as #4047.** |
| 5076 | Gaurav Patwardhan | 11.21 | 206.34 | 802.11be should describe the usage of BSS Transition Management Query signaling by a non-AP MLD to query suitable neighbor AP MLDs. | As in comment. | **Revised**Agree with the commenter. The changes corresponding to the comment have already been proposed and approved in document 11-21/1710r5 as a resolution for CID 5322. The changes in document 11-21/1710r5 expand the BSS Transition Management framework from an AP to an AP MLD. Thus, no technical changes are required for the resolution of this comment. A reference to the subclause added in doc 11-21/1710r5 is added.**TGbe editor: Please implement the changes shown in document 11-21/2027r3 tagged as #4047.** |
| 5914 | Li-Hsiang Sun | 35.3.4.3 | 253.23 | "by the AP corresponding to the transmitted BSSID in the same multiple BSSID set as at least one of the APs affiliated with the AP MLD"Can there be 2 APs affiliated with the AP MLD and be the same multi-BSSID set as the transmitted BSSID? | remove "at least" | **Rejected**The statement indicates that the discovery can occur on any link on which an AP affiliated with the AP MLD operates. As long as a STA affiliated with the non-AP MLD receives a frame carrying the ML element on one of the links, the AP MLD is discovered.  |
| 5978 | Liwen Chu | 35.3.4.3 | 253.21 | discovering one AP MLD is not always right in the case of transmitted BSSID | As in comment | **Rejected**The statements in the subclause apply for both cases where – (a) the discovered AP and AP MLD correspond to the transmitted BSSID, and (b) the discovered AP and AP MLD correspond to the nontransmitted BSSID. For example, in the statement ‘receives an ML probe response from an AP affiliated with the AP MLD or the AP corresponding to the transmitted BSSID in the same multiple BSSID set as at least one of the APs affiliated with the AP MLD’ the first part of the statement describes case (a) while the second part describes case (b) |
| 6751 | Romain GUIGNARD | 35.3.4.3 | 0.00 | Why a non-AP MLD shall be able to determine that several Aps are affiliated with the same AP MLD by using the the MLD MAC address instead of MLD ID which seems dedicated to this purpose. | insert alternative by using MLD ID | **Rejected**The MLD ID subfield is used only in the Reduced Neighbor Report element. It is a subfield within the MLD Parameters subfield. The Basic Multi-Link element does not include the MLD ID field and hence cannot be used to identify the MLD with which the reported AP is affiliated. |
| 6981 | Sanghyun Kim | 35.3.4.3 | 253.41 | The non-AP MLD shall not try to perform multi-link setup with the Soft AP MLD through the non-primary link of the Soft AP MLD. Because the Soft AP MLD can not transmit Probe Response frame on the non-primary link. | Clarify a restriction of the multi-link setup procedure regarding Soft AP MLD. | **Revised**Agree with the commenter in principle. The non-AP MLD rules for transmitting Association Request frames already exist in D1.4. The behavior for the transmission of Probe Request frames was added in the CR document 11-21/1210r9. **TGbe editor: No further changes are required for the resolution of this CID** |
| 6198 | Michael Montemurro | 35.3.4.3 | 253.18 | I'm not sure what behavior this clause is requiring. There is no real requirement to transmit or receive anything. | This clause should provide some requirements on some specific behavior of the non-AP MLD. At this point, phrases like "shall be able to discover" are too vague to derive any behavior. | **Revised**The text in the subclause was revised to provide clear rules on how a non-AP MLD or its affiliated STA can discover an AP MLD and its affiliated STAs.**TGbe editor: Please implement the changes shown in document 11-21/2027r4 tagged as #6198.** |
| 7456 | Thomas Derham | 35.3.4.3 | 0.00 | what does it mean to "be able to discover" as a normative requirement? we don't have this language in baseline | Delete or replace with a meaningful normative requirement | **Revised**The text in the subclause was revised to provide clear rules on how a non-AP MLD or its affiliated STA can discover an AP MLD and its affiliated STAs.**TGbe editor: Please implement the changes shown in document 11-21/2027r4 tagged as #6198.** |
| 4025 | Abhishek Patil | 9.6.7.36 | 155.01 | In order to aid fast discovery of other APs of the AP MLD, RNR IE, when present in a FILS Discovery frame transmitted by an AP affiliated with an AP MLD, must include the other AP(s) affiliated with the reporting AP's AP MLD and operating on other links. | As in comment | **Revised**Agree with the commenter. The conditions for the inclusion of the RNR element in the FILS Discovery frame are updated. When the AP transmitting a FILS Discovery frame is affiliated with an AP MLD, the updated rules allow the AP to carry an RNR element with a TBTT Information field corresponding to other AP(s) affiliated with the same AP MLD. The corresponding non-AP MLD behavior is also added.**TGbe editor: please implement the changes shown in document 11-21/2027r4 tagged as #4025.** |
| 7893 | Yongho Seok | 9.6.7.36 | 155.01 | The FILS Discovery frame should provide the MLO related information. | As in the comment. | **Revised**Agree with the commenter. The conditions for the inclusion of the RNR element in the FILS Discovery frame are updated. When the AP transmitting a FILS Discovery frame is affiliated with an AP MLD, the updated rules allow the AP to carry an RNR element with a TBTT Information field corresponding to other AP(s) affiliated with the same AP MLD. The corresponding non-AP MLD behavior is also added.**TGbe editor: please implement the changes shown in document 11-21/2027r4 tagged as #4025.** |
| 6011 | Liwen Chu | 9.4.2.177 | 126.13 | FILS capabille should be MLD level feature. | As in comment | **Rejected**FILS Discovery provides rules for enhancing the connectivity (for example, reducing the number of probes sent to the AP) at the link level. Therefore, FILS capability should be link-level and not MLD level. |
| 5336 | Jarkko Kneckt | 9.6.7.36 | 155.45 | The FILS Minimum Rate should indicate the rate that is used to transmit the FILS frame. There is no point on signaling the minimum rate, because information is not accurate. The FILS frame transmission parameters should follow the Beacon frame transmission parameters and the transmission parameters should be signaled in the details. | Please allow AP MLD to signal the exact FILS Discovery frame transmission parameters. Change the rate to be the exact rate that is signaled in the FILS Discovery frame. The other transmission parameters of the FILS Discovery frame should be taken from the signaled Beacon transmission parameters. | **Rejected**The FILS Minimum Rate subfield indicates the minimum rate at which the FILS Discovery frame is transmitted by the AP and the minimum rate of subsequent frame exchanges between the AP and the FILS STA. If the meaning of the subfield is revised, legacy FILS STAs will be unaware of the true minimum rate and may cause interoperability issues.  |

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

**35.3.4 Discovery of an AP MLD**

**35.3.4.3 Non-AP MLD behavior**

***TGbe editor: Please add the following paragraph as shown below***

A non-AP MLD discovers an AP MLD and its affiliated APs using one or more of the following: (#6198)

* a STA affiliated with the non-AP MLD (#6198) receives a Basic Multi-Link element carried in a Beacon frame or Probe Response frame, that is not an ML probe response, transmitted by an AP affiliated with the AP MLD or by the AP corresponding to the transmitted BSSID in the same multiple BSSID set as at least one of the APs affiliated with the AP MLD.
* a STA affiliated with the non-AP MLD (#6198) receives an ML probe response from an AP affiliated with the AP MLD or the AP corresponding to the transmitted BSSID in the same multiple BSSID set as at least one of the APs affiliated with the AP MLD carrying a Basic Multi-Link element with a complete profile of the reported AP.
* a STA affiliated with a non-AP MLD (#6198) receives a Beacon,Probe Response or FILS Discovery frame (#4025) frame transmitted by an AP (reporting AP) and the frame carries a Reduced Neighbor Report element that includes the MLD Parameters subfield in the TBTT Information field corresponding to the reported AP. A non-AP MLD (#6198)infers the relationship between the reported AP and the reporting AP by decoding the MLD ID subfield of the MLD Parameters subfield in the Reduced Neighbor Report element and following the rules described in 35.3.4.1 (AP behavior).
* a STA affiliated with the non-AP MLD and the frame carries a Neighbor Report element s. The reported APs are affiliated with the same AP MLD (#6198)

A non-AP MLD can use the information it gathers from a Reduced Neighbor Report element and a Basic Multi-Link element to decide whether to perform multi-link setup with an AP MLD.

(#6198) A non-AP MLD can use the information it receives from a Neighbor Report element to make a decision on performing multi-link (re)setup (see 35.3.5 (Multi-link (re)setup)) or BSS transition (see 4.5.3.2 (Mobility types) and 35.3.25 (BSS transition management for MLDs) (#4047)). (#6198)

**9.6.7.36 FILS Discovery frame format**

***TGbe editor: Please update Table 9-427 as shown below***

**Table 9-427 – FILS Discovery frame format**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| 4 | Reduced Neighbor Report element | One or more Reduced Neighbor Report elements are optionally present if dot11FILSActivated or dot11ColocatedRNRImplemented or dot11MultiLinkActivated (#4025)is true; otherwise, they are not present. |

**35.3.4 Discovery of an AP MLD**

**35.3.4.1 AP behavior**

***TGbe editor: Please revise the following paragraphs as shown below***

If an AP is affiliated with an AP MLD and does not correspond to a nontransmitted BSSID, then the Beacon and Probe Response frames transmitted by the AP shall include a TBTT Information field in a Reduced Neighbor Report element with the Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield, the 20 MHz PSD subfield, and the MLD Parameters subfield, for each of the other APs affiliated with the same AP MLD. A FILS Discovery frame transmitted by the AP may include a Reduced Neighbor Report element with the same information (#4025).

If an AP (AP 1) is affiliated with an AP MLD (AP MLD 1) and corresponds to a nontransmitted BSSID, then the Beacon and Probe Response frames transmitted by the AP (AP 2) corresponding to the transmitted BSSID of the same multiple BSSID set as the AP (AP 1) shall include a TBTT Information field in a Reduced Neighbor Report element with the Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield, the 20 MHz PSD subfield, and the MLD Parameters subfield, for each of the other APs affiliated with the same AP MLD (AP MLD 1). A FILS Discovery frame transmitted by the AP (AP 2) may include a Reduced Neighbor Report element with the same information (#4025).

If all the following conditions are true:

* a reporting AP is affiliated with an AP MLD (AP MLD 1) and is in the same co-located AP set as APs affiliated with another AP MLD (AP MLD 2)
* the other AP MLD (AP MLD 2) has no affiliated APs operating on the same channel as the reporting AP
* one AP affiliated with the other AP MLD (AP MLD 2) is in the same multiple BSSID set as an AP affiliated with the AP MLD (AP MLD 1) of the reporting AP

then each AP of the other AP MLD (AP MLD 2) shall be reported in a TBTT Information field with the Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-BSSID subfield, the BSS Parameters subfield, the 20 MHz PSD subfield, and the MLD Parameters subfield in the Reduced Neighbor Report element that is included in the Beacon frames and broadcast Probe Response frames transmitted by the reporting AP and may be reported in a FILS Discovery frame that includes a Reduced Neighbor Report element transmitted by the reporting AP (#4025), unless the APs of the other AP MLD (AP MLD 2) are already reported in Beacon frames and broadcast Probe Response frames transmitted by an AP in the same co-located AP set as the reporting AP and operating on the same channel as the reporting AP.

**PART II – CIDs on EMLSR**

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| **CID** | **Commenter** | **Section** | **Pg.Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 5451 | Jian Yu | 35.3.15 | 281.36 | There is no OFDM PPDU | Clarify what does OFDM PPDU mean, non-HT PPDU or something else | **Revised**Disagree with the comment. In TGme D1.0, the OFDM PPDU is defined as follows: “**orthogonal frequency division multiplexing (OFDM) physical layer (PHY) protocol data unit (PPDU):**A Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) PPDU.”However, since the text limits the rates to be 6, 9, 12,and 24 Mbps, we can safely replace OFDM PPDU with non-HT PPDU.**TGbe editor: Please implement the changes shown in doc 11-21/2027r3 tagged as #5451** |
| 8048 | Yuchen Guo | 35.3.15 | 281.36 | "non-HT PPDU" is a better term than "OFDM PPDU" since it's more widely used in the SPEC text | change "OFDM PPDU" to "non-HT PPDU" | **Accepted** |
| 6324 | Ming Gan | 35.3.15 | 281.40 | Please change "mandatory" to its corresponding normative behavior | as in the comment | **Revised**Normative behavior was added in Clause 35.3.16 to indicate that reception of MU-RTS and BSRP is mandatory while the non-AP MLD is in the listening operation of the EMLSR mode.**TGbe editor: Please implement the changes shown in doc 11-21/2027r4 tagged as #6324** |
| 4421 | Arik Klein | 35.3.15 | 281.40 | The sentence "Reception of MU-RTS and BSRP Trigger frames is mandatory for a non-AP MLD that is inthe EMLSR mode" seems redundant, since all HE STA (and EHT STA) are required to receive MU-RTS and BSRP (which are 2 variants of Trigger frame). | Please remove the sentence "Reception of MU-RTS and BSRP Trigger frames is mandatory for a non-AP MLD that is inthe EMLSR mode" | **Revised** The cited statement refers to the ability of STAs of the non-AP MLD to receive the two frames while the non-AP MLD is in the EMLSR mode and in listening operation. This is different from the STAs’ ability to receive these two frames in other modes. Therefore, the statement is not redundant. The statement was revised to highlight the above.**TGbe editor: Please implement the changes shown in doc 11-21/2027r4 tagged as #4421** |
| 7467 | Thomas Handte | 35.3.15 | 281.40 | "... that is in the EMLSR mode" Being in EMLSR mode is different than supporting this mode | "... that supports EMLSR mode" | **Rejected**The cited statement refers to the ability of STAs of the non-AP MLD to receive the two frames while the non-AP MLD is in the EMLSR mode and in listening operation, which is applicable only when the non-AP MLD is operating in the EMLSR mode. A non-AP MLD may support the EMLSR mode but may not be operating in the EMLSR mode. The statement does not apply to such cases. |
| 8356 | Zhiqiang Han | 35.3.15 | 281.55 | "its spatial stream capabilities " is not clear, it means the total spatial stream capabilities of all links? | Please clarify it | **Revised**Agree with the commenter in principle. The statement was revised to indicate that the spatial stream capabilities refer to its per-link capabilities. **TGbe editor: Please implement the changes shown in doc 11-21/2027r3 tagged as #8356** |
| 4699 | Chien-Fang Hsu | 35.3.15 | 281.56 | "the more than one spatial stream" here is not clear. It should be specifed exactly how many spatial streams can be supported by a capability indication or other information announced in an element. Also, supported spatial streams should apply to all enabled links in EMLSR mode of the non-AP MLD | clarify the number of spatial stream can be supported | **Revised**The statement was revised to indicate that the per-link spatial stream capabilities and the operating mode as indicated by the non-AP MLD dictate the exact number of spatial streams used by the AP MLD and non-AP MLD during frame exchanges.**TGbe editor: Please implement the changes shown in doc 11-21/2027r3 tagged as #4699** |
| 6069 | Liwen Chu | 35.3.15 | 281.17 | It seems that the Nss of all links under eMLSR should have same Nss support. However since Nss is defined in different links and there is no Nss MCS support in eMLSR MLD level, an eMLSR can announce different Nss support for different links. This can help the case where different links have different requirement, e.g. avoiding interference of different radios in the device. | Make this clear through adding the text that an eMLSR MLD can announce the different Nss for different links. | **Revised**The statement was revised to indicate that the per-link spatial stream capabilities and the operating mode as indicated by the non-AP MLD dictate the exact number of spatial streams used by the AP MLD and non-AP MLD during frame exchanges.**TGbe editor: Please implement the changes shown in doc 11-21/2027r3 tagged as #4699** |

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

**35.3.16 Enhanced multi-link single radio operation**

When a non-AP MLD is operating in the EMLSR mode with an AP MLD supporting the EMLSR mode, the following applies:

…

* The initial Control frame of a frame exchange sequence shall be sent in the non-HT (#5451) PPDU or non-HT duplicate PPDU format using a rate of 6 Mbps, 12 Mbps, or 24 Mbps.
* The initial Control frame shall be an MU-RTS Trigger frame or a BSRP Trigger frame. A STA affiliated with a non-AP MLD that is in the listening operation and that receives an MU-RTS Trigger Frame or BSRP Trigger frame addressed to it shall respond as defined in 35.4.2.2 (Rules for soliciting UL MU frames) except when the frame exchanges initiated by the initial Control frame on one of the EMLSR links overlaps with group addressed frame transmissions on the other EMLSR link where the non-AP STA intends to receive the group addressed frames (#6324). The number of spatial streams for the response to the BSRP Trigger frame shall be limited to 1.
* …
* After receiving the initial Control frame of a frame exchange sequence, the non-AP MLD shall be able to transmit or receive on the link in which the initial Control frame was received and shall not transmit or receive on the other EMLSR link(s) until the end of the frame exchange sequence, and subject to its per-link (#8356) spatial stream capabilities (9.4.2.55.4(Supported MCS Set field), 9.4.2.157.3(Supported VHT-MCS and NSS Set field), 9.4.2.248.4(9.4.2.248.4 Supported HE-MCS And NSS Set field), and 9.4.2.313.4(9.4.2.313.4 Supported EHT-MCS And NSS Set field)) and operation mode (see 26.9 (Operating mode indication)) (#4699), and link switch delay, the non-AP MLD shall be capable of receiving a PPDU that is sent using more than one spatial stream on the link in which the initial Control frame was received a SIFS after the end of its response frame transmission solicited by the initial Control frame. During the frame exchange sequence, the AP MLD shall not transmit frames to the non-AP MLD on the other EMLSR link(s). The non-AP MLD switches back to the listening operation on the enabled links immediately after the end of the frame exchange sequence.

NOTE – If a STA affiliated with a non-AP MLD updates its operation mode and indicates it only supports one spatial stream, an AP MLD follows the updated operation mode and transmits a PPDU with one spatial stream after receiving an immediate response frame following the initial Control frame (#4699).