### IEEE P802.11Wireless LANs

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| 11be D0.3 CR for 35.3.11 |
| Date: 2021-02-23 |
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Abstract

This submission proposes resolutions for the following CIDs:

1162, 1163, 1174, 2914, 2328, 2913, 1632, 2056, 2751, 2496, 1077, 1842, 1845, 1101

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Revise resolution of CID 1162 and 1163 based on the comments from Arik.
* Rev 2: Revise based on the comments from Alfred.
* Rev 3: Further revision based on the discussion offline.

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 D0.3 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe D0.3 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** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 1162 | Arik Klein | 83.25 | 10.3.2.14.2 | In Table 10-5: According to TGbe D0.3, In case of STA affiliated with an MLD, MSNS1 space requirements replace the SNS2 space requirements to determine the sequence number of an individually addressed QoS Data frame that is delivered to the associated MLD.What about Qos (+Null) Data frames that are sent from the MLD - are they excluded from MSNS1 similar to their exclusion from SNS2? | Add Clarification in MSNS1 for QoS (+Null) frames transmitted to the associated MLD | Revised - Based on the baseline definition, the QoS(+) Null frame is defined as follows.*QoS (+)Null frame refers to all three QoS data subtypes with an empty frame body: the QoS Nullframe, subtype 1100; the QoS CF-Poll frame, subtype 1110; and the QoS CF-Ack +CF-Poll frame,subtype 1111.*We note that based on the texts in D5.0, SN of QoS (+)Null maybe set to any value, and duplicate detection of QoS(+)Null are ignored. *TR3: Sequence numbers for transmitted QoS (+)Null frames may be set to any value**RR4: For the purposes of duplicate detection using receiver caches, QoS (+)Null frames and, in a non-DMG BSS,QoS Data frames under a (#156)block ack agreement, shall be ignored*To avoid amibugity, we add excluding QoS(+) Null frame in MSNS1.  TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 1162. |
| 1163 | Arik Klein | 84.22 | 10.3.2.14.2 | In Table 10-6: According to TGbe D0.3, In case of STA affiliated with an MLD, MRC1 space requirements replace the RC2 space requirements to discard duplicate individually addressed QoS Data frames belonging to a TID without BA negotiation that are delivered from the associated MLD.1. What about Qos (+Null) Data frames that are sent from the associated MLD - are they excluded from MRC1 similar to their exclusion from RC2?2. What about the RC7, RC8, RC9, and RC10 that are sent from the associated MLD - are they excluded from MRC1 similar to their exclusion from RC2? | Add clarification in MRC1 for the reception of QoS (+Null) frames as well as for the reception of RC7, RC8,RC9, RC10 (if supported) | Revised - We note that based on the texts in D5.0, duplicate detection of QoS(+)Null are ignored. *RR4: For the purposes of duplicate detection using receiver caches, QoS (+)Null frames and, in a non-DMG BSS,QoS Data frames under a (#156)block ack agreement, shall be ignored*To avoid amibugity, we add excluding QoS(+) Null frame in MLD RC1. Also, note that MLD RC1 only deals with individually addressed data frame reception so we do not add any other exception for group addressed frame. TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 1163. |
| 1174 | Arik Klein | 140.64 | 35.3.11 | The term "finishes transmission" is unclear with the context of the sentence.Assuming that the intention is till the current individually addressed QoS Data frame belonging to the TID without block ack negotiation is successfully received (i.e. with ACK sent from the eliciting STA affiliated with the MLD), the following terminology shall be used "is successfully delivered" as used in the previous sentence. | Revise the sentence as follows: " A STA affiliated with the MLD shall not transmit other individually addressed QoS Data frames belonging to the TID without block ack negotiation to another STA affiliated with the associated MLD on the corresponding link until the current individually addressed QoS Data frame belonging to the TID without block ack negotiation is successfully delivered or is dropped" | Revised - We note that the baseline texts has expression like “has not yet completed to the point of success, retry fail, or other MAC discard“. We revised the texts along the same line.*(#2664)With the exception of a frame belonging to a TID for which block ack agreement is set up, a QoS STA shall not initiate the transmission of any Management or Data frame to a specific RA while the transmission of another Management or Data frame with the same RA and having been assigned its sequence number from thesame sequence counter has not yet completed to the point of success, retry fail, or other MAC discard (e.g., lifetime expiration).(#2432)*TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 1174. |
| 2914 | SunHee Baek | 140.64 | 35.3.11 | It is a suggestion to modify verb format in the sentence without adding new things. | change "finishes transmission or is dropped" to "is completely transferred or dropped" | Revised - We note that the baseline texts has expression like “has not yet completed to the point of success, retry fail, or other MAC discard“. We revised the texts along the same line.*(#2664)With the exception of a frame belonging to a TID for which block ack agreement is set up, a QoS STA shall not initiate the transmission of any Management or Data frame to a specific RA while the transmission of another Management or Data frame with the same RA and having been assigned its sequence number from thesame sequence counter has not yet completed to the point of success, retry fail, or other MAC discard (e.g., lifetime expiration).(#2432)*TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 1174. |
| 2328 | Ming Gan | 140.59 | 35.3.11 | one condition after until is missing, for example, MSDU life time. | As in comment | Revised – Agree in principle with the commenter. We revise in align with the suggestion from the commenter and also clarify that the MSDU timer is in MLD level.TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2328 |
| 2913 | SunHee Baek | 140.59 | 35.3.11 | Does "the retry limit" mean whether "the limit number of retries" of "the retry time limit"? It is confusing. | change "until the retry limit is meet or" to either "until the limit number of retires is meet or" or "until the retry time limit is meet or" | Revised – We note that retry limit and time limit are different things. We add additional condition for lifetime. TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2328 |
| 1632 | Evgeny Khorov | 83.43 | 10.3.2.14.3 | "A STA maintains one or more duplicate detection caches. An MLD maintains one or more duplicate detection caches." Is an MLD composed of several STAs? Should each STA -- a part of an MLD -- maintain one or more duplicate detection caches? Perhaps this point should be stated clearly. | As in comment | Rejected - We explain to the commenter that the following sentence is added in D0.3 to explain the difference. Basically, when affiliates STAs of an MLD receives individually addressed QoS data frame, the duplicate detection is done in MLD level based on MRC1.*All STAs affiliated with an MLD shall implement MRC1 instead of RC2 in Table 10-6 (Receiver caches) to discard duplicate individually addressed QoS Data frames belonging to a TID without BA negotiation that are delivered from the associated MLD.* |
| 2056 | John Wullert | 140.47 | 35.3.11 | Text states that MLD shall follow rules in a cited section. The text in the cited section is written in a non-normative fashion and is more a description of a procedure than "rules" | Describe desired behavior here using normative language. | Rejected - We note to the commenter that normative behaivor is described in 10.3.2.14.2 Transmitter requirements and 10.3.2.14.3 Receiver requirements as shown below.*An MLD shall support the applicable sequence number spaces defined inTable 10-5 (Transmitter sequence number spaces). A STA affiliated with an MLD shall support MSNS1instead of SNS2 in Table 10-5 (Transmitter sequence number spaces) to determine the sequence number ofan individually addressed QoS Data frame that is delivered to the associated MLD.* *An MLD shall implement the applicable receiver requirements defined in Table 10-6 (Receiver caches) with Status indicated as Mandatory. All STAs affiliated with an MLD shall implement MRC1 instead of RC2 in Table 10-6 (Receiver caches) to discard duplicate individually addressed QoS Data frames belonging to a TID without BA negotiation that are delivered from the associated MLD.* |
| 2751 | Sanghyun Kim | 83.03 | 10.3.2.14.2 | There is no definiition or abbreviation of "MSNS1".(multiple sequence number space? or multi-link sequence number space?or MLD sequence number space?) | As in the comment. | Revised –We explain to the commenter that in the baseline SNS1 is used directly as the Sequence number space identifier. We simply revise MSNS1 with MLD SNS1, so it is clear what it means. Similar change for MRC1 and MRR3.TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2751 |
| 2496 | Po-Kai Huang | 140.40 | 35.3.11 | management frame transmission in the baseline follows the same transmision behavior of individual addressed delivery data without BA. For management that may be transmitted in any link, the same behaivor should follow to deal with PMF and duplicate detection. To make sure that the SN space does not conflict with the group addressed SN in each link, a SN space needs to be created for the individual addressed management frame that may be transmitted in any setup link. | Create new SN space and follow the same delivery behavior of individually addressed data frame for individually addressed management frame that maybe sent in any setup link. | Revised – Agree in principle with the commenter. We extend the rule for individually addressed data without BA to individually addressed management frame. A separate sequence number space is created for individually addressed management frame.A separate receiver requirement row is created for individually addressed management frame. We exclude sounding feedback and probe response because they have TSF involved, which is time critical and is hard to implemented with shared sequence number space.We exclude LMR and FTM because in 11az, these frames are dealt with separately. TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2496 |
| 1077 | Abhishek Patil | 140.60 | 35.3.11 | Extend the rules to limit single outstanding MMPDU | As in comment | Revised – Agree in principle with the commenter. We extend the rule for individually addressed data without BA to individually addressed management frame. A separate sequence number space is created for individually addressed management frame.A separate receiver requirement row is created for individually addressed management frame. We exclude sounding feedback and probe response because they have TSF involved, which is time critical and is hard to implemented with shared sequence number space.We exclude LMR and FTM because in 11az, these frames are dealt with separately. TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2496 |
| 1842 | Jarkko Kneckt | 83.20 | 10.3.2.14.2 | The management frames addressed to the STA affiliated with MLD should have own MLD level SN to ensure that management frames can be received over multiple links and that SN can be used to delete duplicates. This would make management frames similar to data frames and simplify their handling. | Please add MLD level SN space (MSNS4) for individually addressed management frames to STA affiliated with MLD | Revised – Agree in principle with the commenter. We extend the rule for individually addressed data without BA to individually addressed management frame. A separate sequence number space is created for individually addressed management frame.A separate receiver requirement row is created for individually addressed management frame. We exclude sounding feedback and probe response because they have TSF involved, which is time critical and is hard to implemented with shared sequence number space.We exclude LMR and FTM because in 11az, these frames are dealt with separately. TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2496 |
| 1845 | Jarkko Kneckt | 84.18 | 10.3.2.14.3 | The individually addressed management frames to the STA affiliated with MLD should be transmitted by using MSNS (MLD level SN space), so these frames need MLD level receiver cache. | Please add receiver cache MRC4 for individually addressed management data frames transmitted STA affiliated with MLD. | Revised – Agree in principle with the commenter. We extend the rule for individually addressed data without BA to individually addressed management frame. A separate sequence number space is created for individually addressed management frame.A separate receiver requirement row is created for individually addressed management frame. We exclude sounding feedback and probe response because they have TSF involved, which is time critical and is hard to implemented with shared sequence number space.We exclude LMR and FTM because in 11az, these frames are dealt with separately. TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2496 |
| 1101 | Alfred Asterjadhi | 82.53 | 10.3.2.14.2 | I am guessing that MGMT frames need a sequence number space. Please clarify. Also are these additional rules needed in this subclause or in the MLD operation? At least add a reference in MLD operation that specifies that these extra rules are located here. Same comment applies to 10.3.2.14.3. | As in comment. | Revised – Agree in principle with the commenter. We extend the rule for individually addressed data without BA to individually addressed management frame. A separate sequence number space is created for individually addressed management frame.A separate receiver requirement row is created for individually addressed management frame. We exclude sounding feedback and probe response because they have TSF involved, which is time critical and is hard to implemented with shared sequence number space.We exclude LMR and FTM because in 11az, these frames are dealt with separately. TGbe editor to make the changes shown in 11-21/0320r3 under all headings that include CID 2496 |

**Discussion:** *None.*

**Propose:**

*TGbe editor: Change 35.3.11Multi-link device individually addressed data delivery without block ack negotiation as follows (track change on):*

* Multi-link device individually addressed data delivery without block ack negotiation

An MLD may deliver individually addressed QoS Data frames belonging to a TID without block ack negotiation to an associated MLD on the setup links subject to additional constraints in 35.3.6 (Link management).

An MLD shall follow the rules described in 10.3.2.14.2 (Transmitter requirements) to determine the sequence number of an individually addressed QoS Data frame belonging to a TID that is delivered to the associated MLD.

An MLD shall follow the rules as described in 10.3.2.14.3 (Receiver requirements) to discard duplicate individually addressed QoS Data frames belonging to a TID without block ack negotiation that are delivered from the associated MLD.

An MLD shall maintain a transmit MSDU timer for each MSDU passed to the MAC. The transmit MSDU timer shall be started when the MSDU is passed to the MAC. STAs affiliated with an MLD shall have the same dot11EDCATableMSDULifetime. (#2328)

An MLD shall continue to deliver the failed individually addressed QoS Data frame belonging to a TID without block ack negotiation to an associated MLD on the setup links subject to additional constraints (see 35.3.6 (Link management)) until one or more of the following conditions occur:

* The retry limit is met.
* The transmit MSDU timer for the MSDU exceeds dot11EDCATableMSDULifetime.
* The individually addressed QoS Data frame is successfully delivered. (#2328)

A STA affiliated with the MLD shall not transmit other individually addressed QoS Data frames belonging to the TID without block ack negotiation to another STA affiliated with the associated MLD while the current individually addressed QoS Data frame belonging to the TID without block ack negotiation has not yet completed to the point of success, retry fail, or other MAC discard (e.g., lifetime expiration).(#1174)

*TGbe editor: Add 35.3.11a Multi-link device individually addressed management frame delivery as follows: (#2496)*

35.3.11a Multi-link device individually addressed management frame delivery

An MLD shall follow the rules described in 10.3.2.14.2 (Transmitter requirements) to determine the sequence number of an individually addressed management frame (except sounding feedback, probe response, LMR and FTM) that is delivered to the associated MLD.

An MLD shall follow the rules as described in 10.3.2.14.3 (Receiver requirements) to discard duplicate individually addressed management frames (except sounding feedback, probe response, LMR and FTM) that are delivered from the associated MLD.

An MLD shall maintain a transmit MMPDU timer for each MMPDU (except sounding feedback, probe response, LMR and FTM). The transmit MMPDU timer shall be started when the MMPDU is passed to the MAC.

An MLD shall continue to deliver the failed individually addressed management frame (except sounding feedback, probe response, LMR and FTM) to an associated MLD on the setup links subject to additional constraints (see 35.3.6 (Link management)) until one or more of the following conditions occur:

* The retry limit is met.
* The transmit MMPDU timer for the MMPDU exceeds dot11EDCATableMSDULifetime.
* The individually addressed management frame is successfully delivered.

A STA affiliated with the MLD shall not transmit other individually addressed management frames (except sounding feedback, probe response, LMR and FTM) to another STA affiliated with the associated MLD while the current individually addressed management frame (except sounding feedback, probe response, LMR and FTM) has not yet completed to the point of success, retry fail, or other MAC discard (e.g., lifetime expiration).

***TGbe editor: Change 10.3.2.14.2 Transmitter requirements as follows (track change on and not all texts are shown):***

 **10.3.2.14.2 Transmitter requirements**

 ***Change the first paragraph as follows:***A STA maintains one or more sequence number spaces that are used when transmitting a frame to determine
the sequence number for the frame. An MLD maintains one or more sequence number spaces that are used when any affiliated STA of the MLD delivering an individually addressed QoS data frame to another affiliated STA of an associated MLD on the corresponding link to determine the sequence number for the frame. An MLD maintains one sequence number space that is used when any affiliated STA of the MLD delivering an individually addressed management frame (except sounding feedback, probe response, LMR and FTM) to another affiliated STA of an associated MLD on the corresponding link to determine the sequence number for the frame.(#2496) When multiple sequence number spaces are supported, the appropriate sequence number space is determined by information from the MAC control fields of the frame to be transmitted. Except as noted below, each sequence number space is represented by a modulo 4096 counter, starting at 0 and incrementing by 1, for each MSDU or MMPDU transmitted using that sequence number space. If dot11MACPrivacyActivated is true, the counter in each sequence number space shall be set to a random number modulo 4096 when the STA’s MAC address is changed.

***Change the fourth paragraph as follows:***

A transmitting STA shall support the applicable sequence number spaces defined in Table 10-5 (Transmitter
sequence number spaces). An MLD shall support the applicable sequence number spaces defined in
Table 10-5 (Transmitter sequence number spaces). A STA affiliated with an MLD shall support MLD SNS1
instead of SNS2 in Table 10-5 (Transmitter sequence number spaces) to determine the sequence number of
an individually addressed QoS Data frame that is delivered to the associated MLD. Applicability is defined
by the Applies to column. The Status column indicates the level of support that is required if the Applies to
column matches the transmission. The Multiplicity column indicates whether the sequence number space
contains a single counter, or multiple counters and in the latter case identifies any indexes. The Transmitter
requirements column identifies requirements for the operation of this sequence number space. The referenced requirements are defined at the end of the table.

***Insert a new row to Table 10-5 (Transmitter sequence number spaces):***.

**Table 10-5—Transmitter sequence number spaces**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sequencenumberspaceidentifier** | **Sequencenumberspace** | **Applies to**  | **Status**  | **Multiplicity**  | **Transmitterrequirements** |
| MLD SNS1 (#2751) | IndividuallyaddressedQoS Data | Any STA affiliated with anMLD transmitting anindividually addressed QoSData frame excluding QoS(+)Null frame.(#1162) | Mandatory  | Indexed by<MLD MACAddress thatthe STAidentified byAddress 1 isaffiliated with,TID> perMLD |  |
| MLD SNS2 | Individually addressed management frame (except sounding feedback, probe response, LMR and FTM) | Any STA affiliated with anMLD transmitting anindividually addressed management frame (except sounding feedback, probe response, LMR and FTM) | Mandatory | Indexed by<MLD MACAddress thatthe STAidentified byAddress 1 isaffiliated with> perMLD(#2496) |  |

***TGbe editor: Change 10.3.2.14.3 Receiver requirements as follows (track change on and not all texts are shown):***

**10.3.2.14.3 Receiver requirements**

***Change the first paragraph as follows:***

A STA maintains one or more duplicate detection caches. An MLD maintains one or more duplicate detection
caches. Table 10-6 (Receiver caches) defines the conditions under which a duplication detection cache is supported and the rules followed by the receiver for the cache. When a Data, Management or Extension frame is
received, a record of that frame is inserted in an appropriate cache. That record is identified by a sequence number and possibly other information from the MAC control fields of the frame. When a Data, Management or
Extension frame is received in which the Retry subfield of the Frame Control field is equal to 1, the appropriate
cache, if any, is searched for a matching frame. In DMG, when a group addressed frame is received the appropriate cache is searched for a matching frame. When a PV1 Data frame or PV1 Management frame is
received, the appropriate cache is searched for a matching frame, regardless of the presence of the Retry subfield of the Frame Control field. If the search is successful, the frame is considered to be a duplicate. Duplicate
frames are discarded.

***Change the third paragraph as follows:***A receiving STA shall implement the applicable receiver requirements defined in Table 10-6 (Receiver caches)
with Status indicated as Mandatory. An MLD shall implement the applicable receiver requirements defined in
Table 10-6 (Receiver caches) with Status indicated as Mandatory. All STAs affiliated with an MLD shall
implement MLD RC1 instead of RC2 in Table 10-6 (Receiver caches) to assist the MLD in discarding duplicate individually addressed QoS Data frames belonging to a TID without BA negotiation that are delivered from the STAs affiliated with the associated MLD.(#2558) All STAs affiliated with an MLD shall
implement MLD RC2 instead of RC1 in Table 10-6 (Receiver caches) to assist the MLD to discard duplicate individually addressed management frame (except sounding feedback, probe response, LMR and FTM) that are delivered from the STAs affiliated with the associated MLD.(#2496) A receiving STA should implement the applicable receiver requirements defined in Table 10-6 (Receiver caches) with Status indicated as Recommended. A receiving STA may implement the applicable receiver requirements defined in Table 10-6 (Receiver caches) with Status indicated as Optional. Applicability is defined by the Applies to column. The Status column indicates the level of support that is required if the Applies to column
matches the received frame. The Multiplicity / Cache size column indicates the indexes that identify a cache
entry and the number of entries that shall be supported. The Receiver requirements column identifies
requirements for the operation of this cache. The referenced requirements are defined at the end of the table.
The requirements relate to caching information that identifies a cache entry and discarding duplicate MPDUs.

***Modify RC1, RC2 and Insert a new row and a new footnote after RR6 to Table 10-6 (Receiver caches):***

**Table 10-6—Receiver caches**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Receivercacheidentifier** | **Cachename** | **Applies to**  | **Status**  | **Multiplicity / Cachesize** | **Receiverrequirements** |
| RC1  | Not QoSData | A STA receiving frames(individually or groupaddressed) that are notQoS Data, excluding ifsupported:RC4RC5RC6RC7RC8RC10MLD RC2 (#2496) | Mandatory  | Indexed by: <Address 2,sequence number,fragment number>.At least the most recentcache entry per<Address 2>. | RR3RR3RR5 |
| RC2  | QoSData | A STA receiving an(individually or groupaddressed) QoS Dataframe, excluding RC3,and if supported:RC7, RC8, RC9, RC10, and MLD RC1 (#1163) | Mandatory  | Indexed by: <Address 2,TID, sequence number,fragment number>.At least the most recentcache entry per<Address 2, TID> pairin this cache. | RR3RR5 |
| MLD RC1  | Individuallyaddressed QoSData  | Any STA affiliated withan MLD receiving anindividually addressedQoS Data frame excluding QoS(+)Null frame.(#1163) | Mandatory  | Indexed by <MLDMAC Address that theSTA identified byAddress 2 is affiliatedwith, TID, sequencenumber> per MLD.At least the most recentcache entry per <MLDMAC Address that theSTA identified byAddress 2 is affiliatedwith, TID> pair in thiscache. | MLD RR3(#2751) |
| MLD RC2 | Individually addressed management frame (except sounding feedback, probe response, LMR and FTM) | Any STA affiliated withan MLD receiving anindividually addressedmanagement frame (except sounding feedback, probe response, LMR and FTM) | Mandatory  | Indexed by <MLDMAC Address that theSTA identified byAddress 2 is affiliatedwith, sequencenumber> per MLD.At least the most recentcache entry per MLDMAC Address that theSTA identified byAddress 2 is affiliatedwith in thiscache. | MLD RR3 (#2496) |
| MLD RR3: The MLD shall discard the frame if the Retry subfield of the Frame Control field is 1 and it matches anentry in the cache.(#2751) |