IEEE P802.11  
Wireless LANs

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| LB164 MRG comment resolutions | | | | |
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|  |  |  |  |  |

Abstract

This document contains proposed resolutions for all the comments (yes all 352 comments!) in the MRG category from LB164. The changes from D1.02 are marked using Word’s change tracking feature. Each change is marked with the CID it pertains to with a (#CID) tag. The first occurance of this tag has a Word comment attached to it, giving the details of the comment, their proposed resolution and whether the CID is accepted (A), accepted in principal (P) or deferred (?).

Declined comments are not in this document. They (along with all comment resolutions) can be found in document 10/1191.

3. Definitions (#88)

Change definition 3.135 as follows:

**3.135 service period (SP):** A contiguous time during which one or more downlink unicast frames are transmitted to a quality of service (QoS) station (STA) and/or one or more transmission opportunities (TXOPs) are granted to the same STA. SPs can be scheduled or unscheduled. For a non-access point (non-AP) STA, there can be at most one non-More Reliable Groupcast (non-MRG)(#616) SP active at any time.

Insert new definitions 3.aa1 through 3.aa10 retaining the alphabetic ordering:

**3.aa1** **No retry/no acknowledgment**(#616) **(Ack):** A retransmission(#961) policy for group addressed frames in which(#544) each frame is transmitted once and without acknowledgement.

**3.aa2** **Active from power save (Active-PS)(#187)**(#616)**:** A (#188)delivery method(#72) for group addressed frames whereby(#72) group addressed frame are(#72) transmitted when all associated(#71) non-access point(#616) (non-AP) stations (STAs)(#616) are in Active mode or after a delivery time indication message (DTIM)(#616) beacon if any associated(#72) non-AP station (STA) is in power save (PS)(#616) mode.

**3.aa3** **More Reliable Groupcast** (**MRG) service** (#546)(#616)**:** Means for transmission and retransmission of medium access control (MAC) service data units (MSDUs) to a destination that is a group address that provides(#787) greater reliability (#547)by using(#787) individually addressed (re)transmissions and group addressed retransmissions, comprising this service,(#73) concealed from MRG-incapable stations(#616).

**3.aa4** **More Reliable Groupcast** (**MRG) group address** (#546) (#616)**:** A group address subject to an MRG agreement between the access point (AP)(#616) and at least one station (STA)(#616) within the basic service set (BSS)(#616).

**3.aa5** **More Reliable Groupcast** (**MRG) frame**(#546)(#616)**:** A group addressed frame transmitted via the MRG service by an access point (AP)(#616).

**3.aa6 More Reliable Groupcast (MRG) Service Period (MRG-SP)(#660) frame**(#546) (#616)**:** A (#660)frame subject to the MRG service when power management mode is MRG-SP. (#550)

**3.aa7 More Reliable Groupcast (MRG) Service Period (MRG-SP) medium access control (MAC) service data unit (MSDU)**(#546)(#616)**:** An MSDU subject to the MRG service with delivery method(#2) (#550) mode equal to MRG-SP.

**3.aa8 More Reliable Groupcast (MRG) Service Period (MRG-SP) aggregate medium access control (MAC) service data unit (A-MSDU)**(#546)(#616)**:** An A-MSDU subject to the MRG service with power management(#550) mode equal to MRG-SP.

**3.aa9 Active More Reliable Groupcast (MRG) Service Period (MRG-SP)**(#546)(#616)**:** A delivery method(#2) for a group addressed stream subject to an MRG agreement (#3)wherein the frames are transmitted at any time without regard to the power state of the non-access point (non-AP)(#616) stations (STAs)(#616) in the group; i.e. a continuous Service Period.

**3.aa? More Reliable Groupcast (MRG) transmission opportunity (TXOP):** An interval of time when an access point (AP) has the right to initiate frame exchange sequences onto the wireless medium (WM) for the purposes of transmitting multiple group addresses frames that are subject to the MRG service.(#843)

4. Abbreviations and acronyms

***Insert the following new abbreviations and acronyms into Clause 4, while maintaining alphabetic ordering:***

MRG More Reliable Groupcast

MRG-SP MRG service period(#76)

DEI Drop Eligibility Indicator

QLDRC QoS long drop-eligible retry counter (#316)

QSDRC QoS short drop-eligible retry counter(#316)

OBSS Overlapping BSS

SCS Stream Classification Service

SCSID Stream Classification Service (#805) Identifier

5. General description

5.2 Components of the IEEE 802.11 architecture

5.2.12 Robust Audio Video Streaming

5.2.12.2 More Reliable Groupcast

The More Reliable Groupcast (MRG)(#80) Service allows a non-AP STA to request greater reliability for one or more group addressed streams that the non-AP STA receives. Greater reliability is provided via transmission as individually addressed frames, unsolicited retries, or the Block Ack mechanism. The non-AP STA may also request delivery when all associated non-AP STAs are in Active mode(#4), so that the AP transmits the frames via EDCA within regular Service Periods.

6. MAC service definition

6.1 Overview of MAC services

6.1.1 Data service

6.1.1.3 Interpretation of service class parameter in MAC service primitives in a STA

Change 6.1.1.3 as follows:

In QoS STAs, the value of the service class parameter in the MAC service primitive (see 6.2) may be a noninteger value of QoSAck or QoSNoAck.

When an MSDU is received from the MAC\_SAP and the recipient STA is a QoS STA with the service class set to

* QoSAck, the MSDU is transmitted using a QoS data frame with the Ack Policy subfield in the QoS Control field set to either Normal Acknowledgment (Normal Ack) or Block Ack.
* QoSNoAck, the MSDU is transmitted using a QoS data frame with the Ack Policy subfield in the QoS Control field set to No Acknowledgment (No Ack). ~~If the sender STA is an AP and the frame has a multicast/broadcast DA, then the MSDU is buffered for transmission and is also sent to the DS.~~

If the sender STA is an AP and the frame is a group addressed MSDU(#778), then the MSDU is buffered for transmission and is also sent to the DS. (#257)

When an MSDU is received from the MAC\_SAP and the recipient STA is not a QoS STA, the MSDU is transmitted using a non-QoS data frame.

When a QoS data frame is received from another STA, the service class parameter in MA-UNITDATA.indication primitive is set to

* QoSAck, if the frame is a QoS data frame with the Ack Policy subfield in the QoS Control field set to either Normal Ack or Block Ack~~.~~, or the frame is an MRG frame.
* QoSNoAck, if the frame is a QoS data frame with the Ack Policy subfield in the QoS Control field set to No Ack. This service class is also used where the DA parameter is a ~~broadcast/multicast~~group address~~.~~ unless the frame is to be delivered via the MRG service(#755).

When a non-QoS data frame is received from a STA, the service class parameter in MA-UNITDATA.indication primitive is set to

* QoSAck, if the frame is ~~a unicast~~ an individually addressed frame and is acknowledged by the STA.
* QoSNoAck, if the frame is a ~~broadcast/multicast~~ group addressed frame ~~and~~or is not acknowledged by the STA.

NOTE— that the ~~broadcast/multicast~~group addressed frames sent by a non-QoS STA are not acknowledged regardless of the service class parameter in MA-UNITDATA.indication primitive.

(#81)MRG frames are only(#567) transmitted by a QoS AP(#756). (#689)

7. Frame formats

7.1 MAC frame formats

7.1.3 Frame fields

7.1.3.1 Frame Control field

7.1.3.1.7 More Data field

Change the fourth paragraph of 7.1.3.1.7 as follows:

The More Data field is set to 1 in ~~broadcast/multicast~~ group addressed frames transmitted by the AP when additional ~~broadcast/multicast~~ MSDUs or MMPDUs that are not part of an active MRG-SP(#808) remain to be transmitted by the AP during this beacon interval. The More Data field is set to 0 in ~~broadcast/multicast~~ group addressed frames transmitted by the AP when no more ~~broadcast/multicast~~ non-MRG-SP group addressed MSDUs or MMPDUs remain to be transmitted by the AP during this beacon interval and in all ~~broadcast/multicast~~ group addressed frames transmitted by non-AP STAs.

Insert the following paragraph after the fourth paragraph of 7.1.3.1.7

The More Data field is set to 0 in all other group addressed frames.

7.1.3.4 Sequence Control field

7.1.3.4.1 Sequence Number field

Change the fourth paragraph of 7.1.3.4.1 as follows:

Each fragment of an MSDU or MMPDU contains a copy of the sequence number assigned to that MSDU or MMPDU. The sequence number remains constant in all retransmissions of an MSDU, MMPDU, or fragment thereof~~.~~, except (#91) when a BU is delivered via DMS, and the No-Ack/No-Retry, MRG-Unsolicited-Retry or MRG-Block-Ack retransmission(#961) policy. In this case the unicast delivery of the BU via (#261) DMS does not need to (#569) match the sequence number of the same BU (re)transmitted using group addressed delivery(#809).

7.1.3.5.2 EOSP (end of service period) subfield

Insert the following paragraph at the end of 7.1.3.5.2:

If dot11RobustAVStreamingImplemented(#29) is true then the HC sets the EOSP field to 1 in a MRG-SP group addressed frame in order to indicate that no more MRG-SP frames of that group address are to be transmitted by the AP until the next scheduled SP for this MRG-SP stream. The EOSP field is set to 0 in a group addressed frame delivered using the Active MRG-SP procedures described in 11.22.15.2.7(#691). (Ed)

7.2 Format of individual frame types

7.2.1 Control frames

7.2.1.7 Block Ack Request (BlockAckReq) frame format

(#120)

7.2.1.7.1 Overview of the BlockAckReq frame format

Change(#263) Figure 7-12 as indicated:

EDITORIAL NOTE—The change comprises adding MRG BAR Information field.

Octets: 2

2

6

6

2

Variable

4

Frame

Control

Duration/ID

RA

TA

FCS

BAR Control

BAR

Information

MRG BAR Information

6

MAC Header

Figure 7-12—BlockAckReq frame

(#605)Change Figure 7-13 as indicatedEDITORIAL NOTE—the changes comprise adding MRG field from the former reserved field.

Reserved

MRG

TID

B10

Bits:

12

4

B~~0~~

B11

B12

B15

1

Figure 7-13—BAR Control field

(#605)(#812)Insert the following text, Figure 7-13aa at the end of 7.2.1.7.1.

The MRG field indicates the presence of the MRG BAR Information field and is set to 1 when the MRG BAR Information field is present and 0 otherwise.(#605)

The MRG BAR Information field is included when the MRG field is set to one and is used to indicate that the block ACK request is requesting the reception status of a group address subject to the MRG service. (#795)(#794)

The format of the MRG BAR Information field is shown in Figure 7-13aa.

|  |  |  |
| --- | --- | --- |
| Octets: | 6 |  |
|  | MRG Group Address |  |

Figure 7-13aa— MRG BAR Information(#605)

(#82)(#571)

The MRG Group Address subfield contains the MAC address of the group for which reception status is being requested.

(#605)(#204)

7.2.1.8 Block Ack (BlockAck) frame format

7.2.1.8.1 Overview of the BlockAck frame format

Change(#263) Figure 7-15 as indicated:

EDITORIAL NOTE—The change is adding MRG Group Address field.

Octets: 2

2

6

6

2

Variable

4

Frame

Control

Duration/ID

RA

TA

FCS

BA Control

BA

Information

MRG Group Address

6

MAC Header

Figure 7-15—BlockAck frame

Change(#263) Figure 7-16 as indicated:

EDITORIAL NOTE—the changes comprise adding MRG field from the former reserved field.

BA Ack

Policy

Multi-TID

Compressed

Bitmap

MRG

Reserved

TID\_INFO

B0

B1

B2

B3

Bits:

1

1

1

1

4

B~~4~~

B11

B12

B15

6

Figure 7-16—BA Control field

Insert the following paragraph after the note starting “NOTE-Reference to “a BlockAck” frame without…”:

When the MRG field is set to 1, the BlockAck is sent in response to a BlockAckReq that contains an MRG BAR(#605)(#94) field. The BlockAck includes the MRG Group Address field when the MRG field is set to 1, and omits the field otherwise.

Insert the following text at the end of 7.2.1.8.1:

The MRG Group Address field is set to the value from the Group Address subfield of the MRG BAR field in the(#605) BlockAckReq frame that the BlockAck frame is sent in response to.

(#816)

7.2.2 Data frames

7.2.2.1 Data frame format

Change the third paragraph of 7.2.2.1 as follows:

A QoS STA always uses QoS data frames for data transmissions to other QoS STAs. A QoS STA uses frames with the QoS subfield of the Subtype field set to 0 for data transmissions to non-QoS STAs. A non-QoS STA always uses frames with the QoS subfield of the Subtype field set to 0 for data transmissions to other STAs. All STAs use frames with the QoS subfield of the Subtype field set to 0 for non-concealed MRG broadcast data frames unless a transmitting STA knows that all STAs in a BSS have QoS capability, in which case the transmitting STAs use QoS data frames. All STAs use frames with the QoS subfield of the Subtype field set to 0 for non-concealed MRG multicast data frames unless it is known to the transmitter that all STAs in the BSS that are members of the multicast group have QoS capability, in which case STAs use QoS data frames. APs use frames with the QoS subfield of the Subtype field set to 1 for concealed MRG frames as described in 11.22.15.2(#695).

7.3 Management frame body components

7.3.1 Fields that are not information elements

7.3.1.aa31 Extended Block Ack Parameter Set

The Extended Block Ack Parameter Set field is used in (#817)ADDBA frames to signal the parameters for setting up a Block Ack. The length of the Extended Block Ack Parameter Set field is 2 octets. The Extended Block Ack Parameter Set field is illustrated in Figure 7-aa36.

ADDBA MRG Group Address Present

Reserved

B0

Bits(#615):

B1

B15

Figure 7-aa36— Extended Block Ack Parameter Set fixed field

2 14

If the ADDBA MRG Group Address Present field is set to 1, then the ADDBA MRG Group Address field is included in the Extended ADDBA frame; otherwise the ADDBA MRG Group Address field is omitted in the Extended ADDBA frame.

7.3.2 Information elements

7.3.2.6 TIM

Change the fifth paragraph of 7.3.2.6 as follows:

The Bitmap Control field is a single octet. Bit 0 of the field contains the Traffic Indicator bit associated with Association ID 0. This bit is set to 1 in TIM elements with a value of 0 in the DTIM Count field when one or more~~broadcast or multicast~~ (#911) group addressed frames are buffered at the AP. The remaining 7 bits of the field form the Bitmap Offset.

Change the last paragraph of 7.3.2.6 as follows:

For both Method A and Method B, when there are no buffered frames at the AP, the Partial Virtual Bitmap field is encoded as a single octet equal to 0, the Bitmap Offset subfield is set to 0, and the Length field is set to 4. When an AP has no buffered unicast frames but has buffered ~~broadcast and/or multicast~~ (#911)group addressed frames, the Partial Virtual Bitmap field consists of the octets number 0 through *N0*-1 where *N0* is the smallest positive integer such that (*N0* × 8 – 2*n*<8). The Bitmap Offset subfield value contains the number 0, and the Length field is set to *N0*+3.

7.3.2.30 TSPEC element

Change the first paragraph of 7.3.2.30 as follows:

The TSPEC element contains the set of parameters that define the characteristics and QoS expectations of a traffic flow, in the context of a particular non-AP STA, for use by the HC and non-AP STA(s) in support of QoS traffic transfer using the procedures defined in 9.2.7.3.2 and . The element information format comprises the items as defined in this subclause, and the structure is defined in Figure 7-82.

Change the Reserved row in Table 7-41 as follows:

Table 7-41—Setting of Schedule subfield

|  |  |  |
| --- | --- | --- |
| APSD | Schedule | Usage |
| 0 | 0 | No Schedule |
| 1 | 0 | Unscheduled APSD |
| 0 | 1 | Scheduled PSMP or MRG-SP~~Reserved~~ |
| 1 | 1 | Scheduled APSD |

***Change paragraphs 6 and 7 of 7.3.2.30 as follows:***

The Minimum Service Interval field is 4 octets long and contains an unsigned integer that specifies the minimum interval, in microseconds, between the start of two successive SPs. If the TSPEC element is included within an MRG Request element that has the MRG delivery method(#2) (#550) set to MRG-SP, a Minimum Service Interval field equal to 0(#700) indicates that Service Periods up to the Maximum Service Interval are requested, including the continuous service period used by the Active MRG-SP Delivery method(#2).

The Maximum Service Interval field is 4 octets long and contains an unsigned integer that specifies the maximum interval, in microseconds, between the start of two successive SPs. The Maximum Service Interval field is greater than or equal to the Minimum Service Interval. If the TSPEC element is included within an MRG Request element that has the MRG delivery method(#2) (#550) set to MRG-SP, a Maximum Service Interval field equal to 0(#700) indicates that the continuous service period used by the Active MRG-SP Delivery method(#2) is requested.

Change paragraph 10 of 7.3.2.30 as follows:

The Service Start Time field is 4 octets and contains an unsigned integer that specifies the time, expressed in microseconds, when the first scheduled SP starts. The service start time indicates to AP the time when a non-AP STA first expects to be ready to send frames and a power-saving non-AP STA will be awake to receive frames. This may help the AP to schedule service so that the MSDUs encounter small delays in the MAC and help the power-saving non-AP STAs to reduce power consumption. The field represents the four lower order octets of the TSF timer at the start of the SP. If APSD and Schedule subfields are~~is~~ set to 0, this field is also set to 0 (unspecified).

7.3.2.34 Schedule element

Change the first paragraph of 7.3.2.34 as follows:

The Schedule element is transmitted by the HC to a non-AP STA to announce the schedule that the HC/AP follows for admitted streams originating from or destined to that non-AP STA, or MRG-SP streams destined to that non-AP STA in the future. The information in this element may be used by the non-AP STA for power management, internal scheduling, or any other purpose. The element information format is shown in Figure 7-93.

Change the third paragraph of 7.3.2.34 as follows:

The Aggregation subfield is set to 1 if the schedule is an aggregate schedule for all TSIDs associated with the non-AP STA to which the frame is directed. It is set to 0 otherwise. The TSID subfield is as defined in 7.1.3.5.1 and indicates the TSID for which this schedule applies., except when the (#412)a Schedule element is sent within a MRG Response element, when the TSID field is reserved. The Direction subfield is as defined in 7.3.2.30 and defines the direction of the TSPEC associated with the schedule. For a Schedule element sent within a MRG Response element, the Direction subfield is set to Downlink. The TSID and Direction subfields are valid only when the Aggregation subfield is set to 0. If the Aggregation subfield is set to 1, the TSID and Direction subfields are reserved.

Change the fifth paragraph of 7.3.2.34 as follows:

The Service Interval field is 4 octets and indicates the time, expressed in microseconds, between two successive SPs and represents the measured time from the start of one SP to the start of the next SP. If the Schedule element is included within an MRG Response element that has the MRG delivery method(#2) (#550) set to MRG-SP, a value of 0(#700) in the Service Interval field indicates the delivery method(#2) is Active MRG-SP.

Change the seventh paragraph of 7.3.2.34 as follows:

In cases other than a Schedule element included within an MRG Response element that has the MRG delivery method(#2) (#550) set to MRG-SP, ~~T~~the HC may set both the Service Start Time field and the Service Interval field to 0 (unspecified) for nonpowersaving STAs.

7.3.2.87 DMS Request element

Change paragraphs 8, 9, and 10 of 7.3.2.87 as follows:

When the Request Type field is set to "Add", the TCLAS elements(#574) field contains one or more TCLAS information elements to specify group addressed frames as defined in 7.3.2.31. When an MRG Request subelement is included in the DMS Descriptor and the Request Type field is set to “Add”, the TCLAS Elements field contains at least a(#759) (#273) TCLAS information element with Frame classifier type equal to 0 (Ethernet parameters) to specify a destination group address as defined in 7.3.2.31. When the Request Type field is set to any value other than "Add", the TCLAS Elements field contains zero TCLAS elements.

When the Request Type field is set to “Add” and when there are two or more TCLAS information elements present, the TCLAS Processing Element field optionally contains one TCLAS Processing information element to define how these TCLAS information elements are to be processed, as defined in 7.3.2.33. Otherwise, the TCLAS Processing Element field contains zero TCLAS Processing information elements. (#759)

When the Request Type field is set to “Add” or “Change”, the TSPEC Element field optionally contains one TSPEC information element to specify the characteristics and QoS expectations of the corresponding traffic flow as defined in 7.3.2.30. When an MRG Request subelement is included in the DMS Descriptor and the Request Type field value is set to “Add” or “Change”, the TSPEC Element field contains one TSPEC information element. Otherwise, the TSPEC Element field contains zero TSPEC information elements.

Change the Reserved row in Table 7-43bc as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Table 7-43bc—Optional Subelement IDs for DMS Descriptor | | | |
| Subelement ID | Name | Length field (octets) | Extensible |
| 0~~-220~~ | Reserved |  |  |
| 1 | MRG Request | 2 | Yes |
| 2-220 | Reserved |  |  |
| 221 | Vendor Specific | 3 to 248 |  |
| 222-255 | Reserved |  |  |

Insert the following paragraphs after Table 7-43bc and before paragraph 13.

Each DMS Descriptor contains zero or one MRG Request subelements. If present and the Request Type field is set to “Add” or “Change”, the MRG Request subelement indicates a request by a non-AP STA to its associated AP to respectively add or change the MRG service for a group address stream identified by the TCLAS information element or DMSID in the DMS Descriptor, respectively. The format of the MRG Request subelement is shown in Figure 7-aa3.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | Subelement ID | Length | MRG Retransmission (#961)Policy | MRG Delivery method(#2) |
| Octets: | 1 | 1 | 1 | 1 |
|  | Figure 7-aa3—MRG Request subelement field | | | |

The value of the MRG Request subelement Length field is 2.

The MRG Retransmission(#961) Policy field is set to indicate the non-AP STA’s preferred retransmission(#961) policy for the group address for which the MRG service is requested. The values are shown in Table 7-aa2.

|  |  |  |
| --- | --- | --- |
| Table 7-aa2— MRG Ack Policy field values | | |
| Value | MRG Retransmission Policy | Notes |
| 0 | No Preference(#208) |  |
| 1 | DMS(#960) | See 11.22.15.1(#760) |
| 2 | MRG-Unsolicited-Retry | See 11.22.15.2(#760) |
| 3 | MRG-Block-Ack | See 11.22.15.2(#760) |
| 4-255 | Reserved |  |

The MRG Delivery method(#2) field is set to indicate the non-AP STA’s preferred Delivery method(#2) for the group address for which the MRG service is requested. The values are shown in Table 7-aa3.

|  |  |  |
| --- | --- | --- |
| Table 7-aa3— MRG Delivery method(#2) field values | | |
| Value | MRG Delivery method(#2) | Notes |
| 0 | No Preference(#208) |  |
| 1 | Active -PS(#187) or FMS |  |
| 2 | MRG-SP | See 11.22.15.2.7 |
| 3-255 | Reserved |  |

7.3.2.88 DMS Response element

Change the fourth paragraph of 7.3.2.88 as follows:

The Status field indicates the status returned by the AP responding to the non-AP STA's request or indicates the DMS Status is an advertisement by the AP of an existing MRG service in the BSS, as indicated in Table 7-43bd.

Change Table 7-43bd as follows:

|  |  |  |
| --- | --- | --- |
| Table 7-43bd—Status field values | | |
| Field value | Description | Notes |
| 0 | Accept | AP accepts the DMS or MRG request |
| 1 | Denied | AP rejects the DMS or MRG request |
| 2 | Terminate | AP terminates the previously accepted DMS or MRG request |
| 3 | MRG Advertise | AP advertises a group addressed stream subject to an existing MRG agreement(#418) |
| ~~3~~4-255 | Reserved |  |

Change paragraphs10, 11, and 12 of 7.3.2.88 as follows:

When the Status field is set to “Accept” or “Denied” and an MRG Response subelement is not included in the DMS Status field, the TCLAS Elements field contains one or more TCLAS information elements to specify group addressed frames as defined in 7.3.2.31. When the Status field is set to “Accept”, “Denied” or “MRG Advertise” and an MRG Response subelement is included in the DMS Status field, the TCLAS Elements field contains at least(#759) one TCLAS information element with Frame classifier type equal to 0 (Ethernet parameters) to specify a destination group address as defined in 7.3.2.31. Otherwise, the TCLAS Elements field contains zero TCLAS information elements.

When the Status field is set to “Accept” or “Denied”, the TCLAS Processing Element field optionally contains one TCLAS Processing information element to define how these TCLAS information elements are to be processed, as defined in 7.3.2.33. When the Status field is set to “Terminate” or when there is only one TCLAS information element, the TCLAS Processing Element field contains zero TCLAS Processing elements. (#759)(#419)

When the Status field is set to “Accept” or “Denied”, the TSPEC Element field optionally contains one TSPEC information element to specify the characteristics and QoS expectations of the corresponding traffic flow as defined in 7.3.2.30. When an MRG Response subelement is included in the DMS Status field and the Type field value is set to “Accept”, “Denied” or “MRG Advertise”, the TSPEC Element field contains one TSPEC information element. Otherwise, the TSPEC Element field contains zero TSPEC elements.

***Change the reserved rows of Table 7-43be as follows:***

|  |  |  |  |
| --- | --- | --- | --- |
| Table 7-43be—Optional Subelement IDs for DMS Status | | | |
| Subelement ID | Name | Length field (octets) | Extensible |
| 0~~-220~~ | Reserved |  |  |
| 1 | MRG Response | 1 to 249 | Subelements |
| 2-220 | Reserved |  |  |
| 221 | Vendor Specific | 3 to 248 |  |
| 222-255 | Reserved |  |  |

Insert the following paragraphs after Table 7-43be and before paragraph 15.

The MRG Response subelement contains a response by an AP to an MRG request by a non-AP STA for MRG service for a group address, or an unsolicited(#572) advertisement for the parameters of a group addressed stream subject to the MRG service.

The format of the MRG Response subelement is shown in Figure 7-aa4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | Subelement ID | Length | MRG Retransmission(#961) Policy | MRG Delivery method(#2) | Schedule element |
| Octets: | 1 | 1 | 0 or 1 | 0 or 1 | 0 or 14 |
| Figure 7-aa4—MRG Response subelement field | | | | | |

The MRG Retransmission(#961) Policy, MRG Delivery method(#2) and Schedule element(#764) fields are present when the Status field is not equal to Denied(#159); otherwise they are omitted.

The MRG Retransmission(#961) Policy field is set to indicate the current MRG retransmission policy selected by the AP for the group address for which the MRG service is requested. The values are shown in Table 7-aa3(#665).



The Delivery methodfield is set to indicate the current MRGDelivery method(#2) selected by the AP for the group address for which the MRG service is requested. The values are shown in Table 7-aa3(#664)



The Schedule Element field is present if the MRG Delivery method(#2) field is equal to MRG-SP. It indicates the current SP schedule for the group addressed stream (see ).

7.4.2.6aa ADDTS Complete frame format

An ADDTS Complete action frame is used to by a non-AP STA to indicate the completion of an AP Initiated TS Setup procedure () (#299). The frame body of the ADDTS Complete frame contains the information shown in Table 7-48aa (ADDTS Complete frame body).

Table 7-48aa—ADDTS Complete frame body

|  |  |
| --- | --- |
| Order | Information |
| 0 | Category |
| 1 | Action |
| 2 | Higher Layer Stream ID |
| 3 | Status Code |

The Category field is set to 1 (representing QoS).

The Action field is set to 4 (representing ADDTS Complete).

The Higher Layer Stream ID is defined in (Higher Layer Stream ID element).

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

7.4.4 Block Ack Action frame details

Change the first paragraph of 7.4.4 as follows:

The ADDBA frames are used to set up or, if PBAC is used, to modify Block Ack for a specific TC, ~~or~~ TS or MRG group address. The Action field value associated with each frame format within the Block Ack category is defined in Table 7-54.

Insert Action field values 3 and 4, and change the Reserved Action field values row (3-255) in Table 7-54 as follows (note that the entire table is not shown here):

Table 7-54—Block Ack Action field values

|  |  |
| --- | --- |
| Action field values | Meaning |
| <ANA> | Extended ADDBA Request |
| <ANA> | Extended ADDBA Response |
| ~~3~~5–255 | Reserved |

7.4.4.aa4(#713) Extended ADDBA Request frame format

ADDBA Request frame is sent by an originator of Block Ack to another STA. The frame body of an Extended ADDBA Request frame contains the information shown in Table 7-aa4.

Table 7-aa4—Extended ADDBA Request frame body

|  |  |
| --- | --- |
| Order | Information |
| 1 | Category |
| 2 | Action |
| 3 | Dialog Token |
| 4 | Block Ack Parameter Set |
| 5 | Block Ack Timeout Value |
| 6 | Block Ack Starting Sequence Control |
| 7 | Extended Block Ack Parameter Set |
| 8 | ADDBA MRG Group Address |

The Category field is set to 3 (representing Block Ack).

The Action field is set to <ANA> (representing Extended ADDBA request).

The Dialog Token field is set to a nonzero value chosen by the STA.

The Block Ack Parameter Set field is defined in 7.3.1.14.

The Block Ack Timeout Value field is defined in 7.3.1.15.

The Block Ack Starting Sequence Control field is defined in 7.2.1.7.

The Extended Block Ack Parameter Set field is defined in (Ed). If the ADDBA MRG Group Address Present field is set to 1 in the Extended Block Ack Parameter Set field, then the TID field within the Block Ack Parameter Set field is reserved.

The ADDBA MRG Group Address field is a 6 octet field equal to the group address for which a Block Ack agreement is requested.

7.4.4.aa5(#713) Extended ADDBA Response frame format

Insert the following additional rows at the end of Table 7-56 (note that the entire table is not shown here):

Table 7-aa5—Extended ADDBA Response frame body

|  |  |
| --- | --- |
| Order | Information |
| 1 | Category |
| 2 | Action |
| 3 | Dialog Token |
| 4 | Status Code |
| 5 | Block Ack Parameter Set |
| 6 | Block Ack Timeout Value |
| 7 | Extended Block Ack Parameter Set |
| 8 | ADDBA MRG Group Address |

The Category field is set to 3 (representing Block Ack).

The Action field is set to <ANA> (representing Extended ADDBA response).

The Dialog Token field value is copied from the corresponding received ADDBA Request frame.

The Status Code field is defined in 7.3.1.9.

The Block Ack Parameter Set field is defined in 7.3.1.14.

The Block Ack Timeout Value field is defined in 7.3.1.15.

The Extended Block Ack Parameter Set field is defined in (Ed). If the ADDBA MRG Group Address Present field is set to 1 in the Extended Block Ack Parameter Set field, then the TID field within the Block Ack Parameter Set field is reserved.

The ADDBA MRG Group Address field is a 6 octet field equal to the group address for which a Block Ack agreement is requested.

7.4.4.3 DELBA frame format

Insert the following additional rows at the end of Table 7-57 (note that the entire table is not shown here):

Table 7-57—DELBA frame body

|  |  |
| --- | --- |
| Order | Information |
| 5 | DELBA MRG Group Address |

Change the fourth paragraph of 7.4.4.3 as follows:

The DELBA Parameters field is defined in . If the DELBA MRG Group Address Present field is set to 1 in the DELBA Parameters field, then the DELBA MRG Group Address field is included in the DELBA frame and the TID field within the DELBA Parameter Set field is reserved. The DELBA MRG Group Address field is not present when the DELBA MRG Group Address Present field is set to 0.(#300)

Insert the following paragraphs at the end of 7.4.4.3:

The DELBA MRG Group Address field is a 6 octet field equal to the MRG group address whose Block Ack agreement is being terminated.

7.4.12.26 DMS Response frame format

Change the first paragraph of 7.4.12.26 as follows:

The DMS Response frame is sent by an AP in response to a DMS Request frame, or autonomously to terminate a requested DMS stream, or to advertise the current parameters for one or more MRG streams. The format of the DMS Response frame is shown in Figure 7-101aw.

7.4.aa13 Robust AV Streaming Action frame details

(#855)7.4.aa13.3 Group Membership Request frame format

The Group Membership Request frame is sent to a STA to request the contents of its dot11GroupAddressesTable. The frame body of Group Membership Request frame contains the information shown in Figure 7-aa23.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | |
|  | Category | Action | Dialog Token | |
| Octets: | 1 | 1 | 1 | |
| Figure 7-aa23—Group Membership Request frame body format | | | |

The Category field is set to <ANA> (representing Robust AV Streaming).

The Action field is set to the value specified in Table 7-aa6 for a Group Membership Request frame.

The Dialog Token field is set to a nonzero value that is unique among the Group Membership Request frames sent by the AP for which a corresponding Group Membership Response frame has not been received.

Usage of the Group Membership Request frame is described in 11.22.15.2.1a

(#855)7.4.aa13.4 Group Membership Response frame format

The Group Membership Response frame is sent in response to a Group Membership Request frame or upon a change in the dot11GroupAddressesTable object, using the procedures defined in 11.22.15.2.1a. The frame body of a Group Membership Response frame contains the information shown in Figure 7-aa24.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | Category | Action | Dialog Token | Address Count | Group Address List |
| Octets: | 1 | 1 | 1 | 1 | variable |
| Figure 7-aa24—Group Membership Response frame body format | | | | | |

The Category field is set to <ANA> (representing Robust AV Streaming).

The Action field is set to the value specified in Table 7-aa6 for a Group Membership Response frame.

The Dialog Token field is set to the nonzero value of the corresponding Group Membership Request frame. If the Group Membership Report frame is being transmitted other than in response to a Group Membership Request frame, the Dialog token is set to 0.

The Address Count field specifies the number of MAC addresses that are in the Group Address List Field.

The Group Address List field contains zero or more MAC addresses to indicate the set of multicast-group MAC addresses for which the STA receives frames.

9.2 DCF

Change the eighth paragraph of 9.2 as follows:

Excepting MPDUs transmitted via the MRG service, ~~T~~the RTS/CTS mechanism cannot be used for MPDUs with broadcast and multicast immediate destination because there are multiple recipients for the RTS, and thus potentially multiple concurrent senders of the CTS in response. For MPDUs transmitted via the MRG service, the RTS may be used if it is(#313) directed to a STA within the MRG group (see (Ed) and ). The RTS/CTS mechanism need not be used for every data frame transmission. Because the additional RTS and CTS frames add overhead inefficiency, the mechanism is not always justified, especially for short data frames.

9.2.7 Broadcast and multicast MPDU transfer procedure

Modify clause(#176) 9.2.7 as follows:

In the absence of a PCF or use of the MRG-service, when group addressed MPDUs in which the To DS field is 0 are transferred from a STA, only the basic access procedure shall be used. When group addressed MPDUs are not delivered using the MRG-service ~~Regardless of the length of the frame~~, no RTS/CTS exchange shall be used, regardless of the length of the frame. In addition, no ACK shall be transmitted by any of the recipients of the frame. Any group addressed MPDUs in which the To DS field is 1 transferred from a STA shall, in addition to conforming to the basic access procedure of CSMA/CA, obey the rules for RTS/CTS exchange and the ACK procedure because the MPDU is directed to the AP. The group addressed message shall be distributed into the BSS. Unless the MPDU is delivered via the DMS service, the ~~The~~ STA originating the message receives the message as a group addressed message (prior to any filtering). Therefore, all STAs shall filter out group addressed messages that contain their address as the source address. Group addressed MSDUs shall be propagated throughout the ESS.

There is no MAC-level recovery on~~broadcast or multicast~~ grouped addressed frames, except for ~~those frames sent with the To DS field set.~~

* (#562)Those frames sent with the To DS field set, or
* Group addressed frames transmitted via the MRG-service(#841).

(#933)

9.2.8 ACK procedure

Insert the following subclause (9.9.1.6.aa1) at the end of 9.9.1.6(#945):

9.9.1.6.aa1 Unsolicited retry procedure

When using the MRG-Unsolicited-Retry delivery method for a group address, the AP may retransmit an MPDU to increase the probability of correct reception of associated STAs that are listening to this group address (i.e. the group address is in their dot11GroupAddressTable). How and when an AP chooses to retransmit these MPDUs is an implementation decision and beyond the scope of this standard.(#942)

A protective mechanism (such as transmitting using HCCA, RTS/CTS, setting the Duration fields in the first frame and response frames to update the NAVs of all STAs in the BSS and OBSS(s)(#211) or another mechanism described in 9.13) should be used to reduce the probability of other STAs transmitting during the MRG TXOP.(#211)(#669)(#844) If there is more than one STA in a MRG group, an AP may use the OBSS information reported by STAs to select the responding STA.

When retransmitting an MPDU, following a MAC protection exchange that includes a response frame, using the MRG service with retransmission(#961) policy equal to MRG-Unsolicited-Retry, for all retransmissions except the final retransmission, the STA shall either transmit the frames within a TXOP(#721) separated by an interframe space (subject to TXOP limits) or(#212) invoke its backoff procedure at the PHY-TXEND.confirm with a CW equal to CWmin. The final retransmission shall follow the backoff procedure defined in 9.9.1.5(#673)(#599)

When retransmitting an MPDU, without MAC protection or with MAC protection that lacks a response frame, using the MRG service with retransmission(#961) policy equal to MRG-Unsolicited-Retry, for all retransmissions except the final retransmission, the STA shall invoke its backoff procedure at the PHY-TXEND.confirm. The final retransmission of an MPDU using the MRG service with Retransmission(#961) policy equal to MRG-Unsolicited-Retry, without MAC protection that includes a response frame, shall cause the STA to invoke its backoff procedure defined in 9.9.1.5(#941) at the PHY-TXEND.confirm with a CW equal to CWmin.(#600)

9.2.9 Duplicate detection and recovery

Change the fourth paragraphs of 9.2.9 as follows:

The receiving STA shall keep a cache of recently received <Address 2, sequence-number, fragment-number> tuples. The receiving QoS STA shall also keep a cache of recently received <Address 2, TID, sequence number, fragment-number> tuples for all STAs from whom it has received QoS data frames. A receiving STA is required to keep only the most recent cache entry per <Address 2-sequence-number> pair, storing only the most recently received fragment number for that pair. A receiving QoS STA is also required to keep only the most recent cache entry per <Address 2, TID, sequence-number> triple, storing only the most recently received fragment number for that triple. If dot11RobustAVStreamingImplemented(#29) is false, a receiving STA may omit tuples obtained from group addressed frames from the cache. If dot11RobustAVStreamingImplemented(#29) is true, the receiving STA is (#96)required to keep a cache entry(#180) per <Address 1, TID, sequence-number> tuple(#179) for each group address subject to an MRG agreement(#180). A receiving STA may omit tuples obtained from ~~broadcast/multicast or~~ ATIM frames from the cache.

Note⎯Group addressed retransmissions of BUs use the same sequence number as the initial group addressed transmission of the BU. Unicast retransmissions of group addressed BU delivered via DMS use the same sequence number as the initial unicast transmission of the BU. When a BU is delivered both using group addressing and unicast (e.g. when DMS is active but there are other associated STAs not using DMS) the sequence number may differ between the group addressed and unicast transmissions of the same BU.(#232)

9.3 PCF

9.3.2 PCF access procedure

9.3.2.1 Fundamental access

Change the second paragraph of 9.3.2.1 as follows:

After the initial Beacon frame, the PC shall wait for one SIFS period, and then transmit one of the following: a data frame, a CF-Poll frame, a Data+CF-Poll frame, a management frame, or a CF-End frame. If the CFP is null, i.e., no traffic is buffered and no polls exist to send at the PC, a CF-End frame shall be transmitted immediately after the initial Beacon frame. If there are buffered~~multicast or broadcast~~ non-MRG-SP group addressed frames, the PC shall transmit these prior to any unicast frames.

9.3.2.4.4 PIFS(#587)

EDITORIAL NOTE: Clause 9.3.2.4.4 is defined in REVmb D6.0

To the bulleted list below the sentence “The PIFS may be used as described in the following list and shall not be used otherwise:” add the following item:

* An AP continuing to transmit in an MRG-Block-Ack TXOP after the failure to receive a BlockAck as described in 9.10.10

9.3.3 PCF transfer procedure

9.3.3.1 PCF transfers when the PC STA is transmitter or recipient

Change the third paragraph of 9.3.3.1 as follows:

The PC may transmit data or management frames to non-CF-Pollable, non-PS STAs during the CFP. These STAs shall acknowledge receipt with ACK frames after a SIFS, as with the DCF. The PC may also transmit ~~broadcast or multicast~~group addressed frames during the CFP. Because the Beacon frame that initiates the CFP contains a DTIM element, if there are associated STAs using PS mode, the~~broadcasts and multicasts~~ buffered group addressed frames that are not delivered via the MGP-SP delivery mode(#854) shall be sent immediately after any Beacon frame containing a TIM element with a DTIM count field with a value of 0.

9.6 Multirate support (#728)

Add the following paragraph to the end of 9.6:

When a BlockAckReq frame is transmitted as part of an MRG service using the MRG-Block-Ack ack polic, a retransmitted BlockAckReq shall use the same rate and modulation mode as the original BlockAckReq.

9.9 HCF

9.9.1 HCF contention-based channel access (EDCA)

9.9.1.5 EDCA backoff procedure

Change the second paragraph of 9.9.1.5 as follows:

For the purposes of this subclause, successful transmission and transmission failure are defined as follows:

* After transmitting an MPDU (regardless of whether it is carried in an A-MPDU) that requires an immediate frame as a response, the STA shall wait for a timeout interval of duration of aSIFSTime + aSlotTime + aPHY-RX-START-Delay, starting at the PHY-TXEND.confirm primitive. If a PHY-RXSTART.indication primitive does not occur during the timeout interval, the STA concludes that the transmission of the MPDU has failed.
* If a PHY-RXSTART.indication primitive does occur during the timeout interval, the STA shall wait for the corresponding PHY-RXEND.indication primitive to determine whether the MPDU transmission was successful. The recognition of a valid response frame sent by the recipient of the MPDU requiring a response, corresponding to this PHY-RXEND.indication primitive, shall be interpreted as a successful response.
* ~~The recognition of anything else, including any other valid frame, shall be interpreted as failure of the MPDU transmission.~~ The recognition of a valid data frame sent by the recipient of a PS-Poll frame shall also be accepted as successful acknowledgment of the PS-Poll frame.
* A transmission that does not require an immediate frame as a response is defined as a successful transmission, unless it is the non-final (re)transmissions an MPDU (as indicated by the More Data field set to 0)(#675) that is delivered using the MRG-Unsolicited-Retry service (9.2.8.1).(#722)
* The non-final (re)transmission of an MPDU (as indicated by the More Data field set to 0) that is delivered using(#722) the MRG-Unsolicited-Retry service ((Ed))) is defined to be a failure.
* The recognition of anything else, including any other valid frame, shall be interpreted as failure of the MPDU transmission.(#181)

9.9.2 HCCA

Change the fifth paragraph of 9.9.2 as follows:

The HC shall perform delivery of buffered ~~broadcast and multicast~~ non-MRG-SP group addressed frames following DTIM Beacon frames. The HC may also operate as a PC, providing (non-QoS) CF-Polls to associated CF-Pollable STAs using the frame formats, frame exchange sequences, and other applicable rules for PCF specified in 9.3.22

9.10 Block Acknowledgment (Block Ack)

9.10.1 Introduction

Change the third paragraph of 9.10.1 as follows:

The Block Ack mechanism does not require the setting up of a TS; however, QoS STAs using the TS facility may choose to signal their intention to use Block Ack mechanism for the scheduler’s consideration in assigning TXOPs. The Block Ack mechanism is also used by the MRG service. Acknowledgments of frames belonging to the same TID, but transmitted during multiple TXOPs, may also be combined into a single BlockAck frame. This mechanism allows the originator to have flexibility regarding the transmission of data MPDUs. The originator may split the block of frames across TXOPs, separate the data transfer and the Block Ack exchange, and interleave blocks of MPDUs carrying all or part of MSDUs or A-MSDUs for different TIDs or RAs.

9.10.2 Setup and modification of the Block Ack parameters

Change the second-to-the-end paragraph of 9.10.2 as follows:

If the Block Ack mechanism is being set up for a TS, bandwidth negotiation (using ADDTS Request and Response frames) should precede the setup of the Block Ack mechanism. If the Block Ack mechanism is being set up for the MRG service, one or more MRG Request/Response exchanges precede the setup of the Block Ack mechanism.

9.10.3 Data and acknowledgment transfer using immediate Block Ack policy and delayed

**Block Ack policy**

Change the first paragraph of 9.10.3 as follows:

After setting up either an immediate Block Ack agreement or a Delayed Block agreement following the procedure in 9.10.2 (Setup and modification of the Block Ack parameters), the originator may transmit a block of QoS data frames separated by SIFS period, with the total number of frames not exceeding the Buffer Size subfield value in the associated ADDBA Response frame. Each of the frames shall have the Ack Policy subfield in the QoS Control field set to Block Ack. The RA field of ~~the~~ frames that are not delivered using the MRG-Block-Ack Retransmission(#961) policy(#584) shall be the recipient’s unicast address. For frames delivered using the MRG-Block-Ack Retransmission(#961) policy, the RA field of the frames shall be the MRG concealment(#463) group address. The originator requests acknowledgment of outstanding QoS data frames by sending a Basic Block-AckReq frame. The recipient shall maintain a Block Ack record for the block.

(#185)

(#605)(#186)

Insert the following subclauses (9.10.10) after 9.10.9:

9.10.10 MRG Block Ack

This subclause extends the Block Ack mechanism to group addressed frames that are subject to the MRG-Block-Ack Retransmission(#961) policy.

A protective mechanism (such as transmitting using an HCCA CAP(#217), RTS/CTS, setting the Duration fields in the first frame and response frames to update the NAVs of all STAs in the BSS and OBSS(s)(#104) or another mechanism described in 9.13) should be used to reduce the probability of other STAs transmitting during the MRG TXOP. The protective mechanism of NAV update can be achieved by setting(#104) (#122) the Duration field in the first and response frames appropriately to cover the entire duration of the TXOP and thereby update the NAVs of STAs in the BSS and OBSS(s) according to the rules of 9.2.5.4(#122). If there is more than one STA in an(#465) MRG group, an AP may use the OBSS information reported by STAs to select the STA used to initiate the protection mechanism.(#465)(#856)

After an AP transmits between one and MRG Buffer Size MSDUs or A-MSDUs with RA set to an MRG group address when the Retransmission(#961) policy for that group address is MRG-Block-Ack, the AP shall send a BlockAckReq to one of the STAs that has an MRG-Block-Ack agreement for this group address. (#605) The AP shall not send a BlockAckReq to a STA with a MAC address that matches the SA in any of the MSDUs transmitted during the MRG TXOP(#128).(#219)

NOTE-As an example of how the above procedure might be implemented(#129), the AP sends a BlockAckReq to one(#219) group member after each MSDU that is delivered using the MRG-Block-Ack Retransmission(#961) policy(#130). The AP begins with the first member of the MRG group and cycles through the members as the AP transmits each subsequent MRG-Block-Ack MSDU(#130).

(#605)When a non-AP STA receives a BlockAckReq with the MRG Group Address subfield equal to an MRG group address the non-AP STA shall transmit a BlockAck frame at a delay of SIFSafter the BlockAckReq. The BlockAck acknowledges the (#135)STA’s reception(#133) status of the block of group addressed frames requested by the BlockAckReq frame. The receive buffer operation, the selection of BlockAck and BlockAckReq variants, and the BlockAck generation shall follow the rules in 9.10.4, 9.10.6, and 9.10.7.

Figure 9-aa1: Typical frame exchange with MRG-Block-Ack Retransmission(#961) policy

AP

Block

AckReq

MRG group member 1

Data

MRG group member 2

MRG group member 3

Data

Data

Block

Ack

(#605)A typical frame exchange sequence using the MRG-Block-Ack Retransmission(#961) policy for a single TID is shown in Figure 9-aa1.

(#605)BlockAckReq and BlockAck frames might(#139) be lost or incorrectly received by the intended recipients. If an AP transmits an MRG BlockAckReq to an MRG group member and(#141) does not successfully receive a BlockAck frame from the STA, then the AP may retransmit, in a new TXOP, a BlockAckReq. The process may be restarted by the AP transmitting an updated BlockAckReq with a new Block Ack Starting Sequence Control field if the data MSDUs requested for acknowledgement in the BlockAckReq have reached their lifetime limit.

(#146)After completing the BlockAckReq and BlockAck frame exchanges, the AP determines from the information provided in the BlockAck bitmap and from the missing BlockAcks which, if any, MSDUs or A-MSDUs that (#679) need to be retransmitted.

An AP adopting the MRG-Block-Ack policy for an MRG group address chooses a lifetime limit for the group address. The AP may vary the lifetime limit for the group address at any time, and may use different lifetime limits for different MRG group addresses. The AP transmits and retries each MSDU or A-MSDU until(#147) the appropriate lifetime limit is reached(#147)(#586), or until each one has been(#147) received by all group members to which a BlockAckReq has been sent(#862), whichever occurs first.

An AP may regularly send a BlockAckReq with the MRG Group Address subfield (#605)set to the MRG group address and the Block Ack Starting Sequence Control set to the Sequence Number(#149) field of the earliest non-lifetime-expired(#148) MSDU or A-MSDU of the MRG stream, for MRG streams with Retransmission(#961) policy equal to MRG-Block-Ack, if other frames are to be transmitted using the same sequence counter(#150) with sequence numbers higher (modulo-4096) than the sequence number within the Block Ack Starting Sequence Control of the last transmitted BlockAckReq sent with the MRG Group Address subfield (#605)set to the MRG group address, in order to minimize buffering latency at receivers in the MRG group.

NOTE-This is because an AP may transmit management frames, QoS data frames with a group address in the Address 1 field (including different MRG streams), and non-QoS data frames intermingled. Since these are transmitted using a single sequence counter, missing frames or frames sent to group addresses absent from a receiving STA’s dot11GroupAddresses table complicates receiver processing for MRG streams with a MRG-Block-Ack Retransmission(#961) policy since the(#326) cause of a hole in a receiver’s Block Ack bitmap is ambiguous: it is due either to an MPDU being lost from the MRG stream or to transmissions of MPDUs not related to the MRG service using the same sequence number counter.

(#106)The beginning of reception of a BlockAck response is detected by the occurrence of PHYCCA. indication(BUSY,channel-list) primitive at the STA that is expecting the response where:

* The channel-list parameter is absent, or
* The channel-list is equal to {primary} and the HT STA expected to transmit the expected response supports 20 MHz operation only, or
* The channel-list is equal to either {primary} or {primary, secondary} and the HT STA expected to transmit the expected response supports both 20 MHz and 40 MHz operation (see 10.15.2 (Basic 20/40 MHz BSS functionality)).

If the beginning of such reception does not occur during the first slot time following a SIFS, then(#106) the AP may perform error recovery by retransmitting a BlockAckReq frame PIFS after the previous BlockAckReq (#605) when both of(#327) the following conditions are met:

* (#562)The carrier (#107)sense mechanism (see 9.2.1) indicates that the medium is idle at the TxPIFS slot boundary (defined in 9.2.10) after the expected start of a BlockAck, and
* (#562)The Duration of the failed BlockAck is longer than the total time of the retransmitted MRG BlockAckReq plus one slot time.

(#605)

NOTE⎯The retransmitted BlockAckReq use the same rate and modulation mode as the original BlockAckReq, see 9.6. (#728)

NOTE⎯(#729)If an AP detects(#988) a missing BlockAck frame in response to the AP's BlockAckReq frame and(#154) there is insufficient time to transmit a recovery frame, the(#729) AP (#729)retransmits the(#729) BlockAckReq frame in a new TXOP(#605).

11. MLME

11.2 Power management

11.2.1 Power management in an infrastructure network

Change the fourth paragraph of 11.2.1(#241) as follows:

In a BSS operating under the DCF, or during the CP of a BSS using the PCF, upon determining that an MSDU or A-MSDU is currently buffered in the AP, a STA operating in the *PS mode* shall transmit a short PS-Poll frame to the AP, which shall respond with the corresponding buffered MSDU or A-MSDU immediately, or acknowledge the PS-Poll and respond with the corresponding MSDU or A-MSDU at a later time. If the TIM indicating the buffered MSDU or A-MSDU is sent during a CFP, a CF-Pollable STA operating in the PS mode does not send a PS-Poll frame, but remains active until the buffered MSDU or A-MSDU is received (or the CFP ends). If any STA in its BSS is in PS mode, the AP shall buffer all non-MRG-SP group addressed MSDUs and deliver them to all STAs immediately following the next Beacon frame containing a DTIM transmission. This is known as Active -PS(#187) Delivery method(#2).

11.2.1.1 STA Power Management modes

Change the second row of Table 11-1 (Power Management modes) as follows:

Table 11-1—Power Management modes

|  |  |
| --- | --- |
| PS | STA listens to selected beacons (based upon the ListenInterval parameter of the MLMEASSOCIATE.request primitive) and sends PS-Poll frames to the AP if the TIM element in the most recent beacon indicates an individually addressed BU is(#189) buffered for that STA.  The AP shall transmit buffered individually addressed Bus(#189) to a PS STA only in response to a PS-Poll from that STA, (#189) during the CFP in the case of a CFPollable PS STA, ~~or~~ during a scheduled or unscheduled APSD service period for the STA(#189), or during the SP of a scheduled MRG-SP. In PS mode, a STA shall be in the Doze state and shall enter the Awake state to receive selected beacons, to receive group addressed transmissions following certain received beacons, or during the SP of a scheduled MRG-SP, to transmit, and to await responses to transmitted PS-Poll frames or (for CF-Pollable STAs) to receive CF transmissions of buffered BUs(#189). |

11.2.1.2 AP TIM transmissions

Change 11.2.1.2 as follows:

The TIM shall identify the STAs for which traffic is pending and buffered in the AP. This information is coded in a *partial virtual bitmap*, as described in 7.3.2.6. In addition, the TIM contains an indication whether group addressed traffic is pending. Every STA is assigned an AID by the AP as part of the association process. AID 0 (zero) is reserved to indicate the presence of buffered non-MRG-SP group addressed MSDUs. The AP shall identify those STAs for which it is prepared to deliver buffered MSDUs or A-MSDUs by setting bits in the TIM’s partial virtual bitmap that correspond to the appropriate AIDs.

11.2.1.3 TIM types

Change the first paragraph of 11.2.1.3 as follows:

Two different TIM types are distinguished: TIM and DTIM. After a DTIM, the AP shall send out the buffered ~~broadcast/multicast~~non-MRG-SP group addressed MSDUs using normal frame transmission rules, before transmitting any unicast frames.

Change the fourth paragraph of 11.2.1.3 as follows:

The third and fourth lines in Figure 11-4 depict the activity of two STAs operating with different power management requirements. Both STAs power-on their receivers when they need to listen for a TIM. This is indicated as a ramp-up of the receiver power prior to the TBTT. The first STA, for example, powers up its receiver and receives a TIM in the first beacon; that TIM indicates the presence of a buffered MSDU or A-MSDU for the receiving STA. The receiving STA then generates a PS-Poll frame, which elicits the transmission of the buffered MSDU or A-MSDU from the AP. Non-MRG-SP ~~G~~group addressed MSDUs are sent by the AP subsequent to the transmission of a beacon containing a DTIM. The DTIM is indicated by the DTIM count field of the TIM element having a value of 0.

11.2.1.4 Power management with APSD

Change the fourth paragraph of 11.2.1.4 as follows:

If there is no unscheduled SP in progress, the unscheduled SP begins when the AP receives a trigger frame from a (REVmb)STA, which is a QoS data or QoS Null frame using(REVmb) an AC the STA has configured to be trigger-enabled. An A-MPDU that contains one or more trigger frames acts as a trigger frame. An unscheduled SP ends after the AP has attempted to transmit at least one BU using(REVmb) a delivery-enabled AC and destined for the non-AP STA(#190) but no more than the number indicated in the Max SP Length field of the QoS Capability element of the STA’s (Re)Association Request frame(REVmb), if the field has a nonzero value. An unscheduled SP may end before the maximum number of BUs in this SP has been reached by setting the EOSP field set to 1 in the last frame sent during the SP.(#240)

Change paragraphs 8 to 11 of 11.2.1.4 as follows:

A scheduled SP starts at fixed intervals of time specified in the Service Interval field. If the scheduled Service Interval field equals 0 (#700), for example with the Active MRG-SP delivery method(#2), the scheduled SP starts(#191) from the Service Start Time without a fixed delivery interval(#191). In order to use a scheduled SP for a TS when the access policy is controlled channel access, a non-AP STA shall send an ADDTS Request frame to the AP with the APSD subfield of the TS Info field in the TSPEC element set to 1. To use a scheduled SP for a TS for a AC when the access policy is contention-based channel access, a non-AP STA shall send an ADDTS Request frame to the AP with the APSD and Schedule subfields of the TS Info field in the TSPEC element both set to 1. If the APSD mechanism is supported by the AP and the AP accepts the corresponding ADDTS Request frame from the non-AP STA, the AP shall respond to the ADDTS Request frame with a response containing the Schedule element indicating that the requested service can be accommodated by the AP. (#193)When the access policy is contention-based channel access for an MRG group addressed stream, a scheduled SP(#193) is set-up according to 11.22.15.2.2(#864). The first scheduled SP starts when the lower order 4 octets of the TSF timer equals the value specified in the Service Start Time field. If the SI is non-zero, the~~A~~ non-AP STA using scheduled SP shall first wake up at the service start time to receive a) downlink ~~unicast~~ individually addressed and/or MRG-SP group addressed frames buffered and/or b) polls from the AP/HC.

If the SI is non-zero, t~~T~~he STA shall wake up subsequently at a fixed time interval equal to the SI. The AP may modify the non-MRG service start time by indicating so in the Schedule element in ADDTS Response frame and in Schedule frames. The AP may modify the MRG service start time by indicating so in the Schedule element in the MRG Response elements (see 9.2.7.3.2). In both non-MRG and MRG cases, the service start time shall be updated (using the previously described service start time modification procedures)(#194) whenever the upper(#329) 4 octets of the TSF timer change.

A scheduled SP begins at the scheduled wakeup time that corresponds to the SI and the service start time indicated in the Schedule element sent in response to a TSPEC or MRG Request. If the SI is non-zero, t~~T~~he STA shall wake up at a subsequent time when

(TSF – service start time) mod minimum SI = 0.

(#240) If the SI is non-zero, a scheduled SP for an MRG group ends after the AP has attempted to transmit at least one BU associated with the MRG group but no more than the number indicated in the Max SP Length field of the QoS Capability element of the STA’s (Re)Association Request frame. The last frame of the MRG SP shall have (#240)the EOSP field set to 1.

When a scheduled Service Period overlaps the transmission after a DTIM beacon where there are buffered frames (non-MRG-SP group addressed frames and frames individually addressed to non-AP STAs in PS mode) that the AP must deliver immediately after the beacon, the scheduled SP is deferred until the AP has transmitted all such(#734) buffered frames.

(#221)If a non-AP STA has an MRG agreement with an AP for a group address using(#735) the Active MRG-SP delivery method(#2), then the non-AP STA shall enter the Awake state and shall remain awake in order to receive the buffered group addressed BUs(#735) until the AP changes the delivery method(#2) to a method(#735) other than Active MRG-SP, or the MRG agreement is canceled.

If non-MRG scheduled services periods are supported in a BSS, a STA may use both unscheduled and scheduled APSD on different ACs at the same time. The(#736) MRG-SP Delivery method(#2) may be used on any AC, irrespective of the non-MRG unscheduled or scheduled APSD flows. When a non-AP STA establishes scheduled delivery for an AC, that AC shall be considered delivery-enabled. However, the AP shall not transmit frames associated with that AC during an SP that is initiated by a trigger frame, and it shall not treat frames associated with the AC that are received from the STA as trigger frames. The AP shall decline any ADDTS Request frame that indicates the use of both scheduled and unscheduled APSD to be used on non-MRG-SP frames of the same AC at the same time.

APSD shall be used only to deliver ~~unicast~~ individually addressed and MRG-SP frames to a STA. Non-MRG and non-MRG-SP frame delivery shall follow the frame delivery rules defined for ~~broadcast/multicast~~ group addressed frames as defined in 11.2.1.6.

11.2.1.5 AP operation during the CP

Change list items d), e) and f) of 11.2.1.5 as follows:

EDITORIAL NOTE—the following change is based on P802.11v\_D14.0.

1. If a non-AP STA has set up a scheduled SP, it shall automatically wake up at each SP. Therefore, the APSD-capable AP shall transmit frames associated with admitted traffic with the APSD subfield set to 1 in the TSPECs buffered for the non-AP STA during a scheduled SP. If the non-AP STA has set up to use unscheduled SPs, the AP shall buffer frames belonging to delivery-enabled ACs until it has received a trigger frame associated with a trigger-enabled AC from the non-AP STA, which indicates the start of an unscheduled SP. A trigger frame received by the AP from a non-AP STA that already has an unscheduled SP underway shall not trigger the start of a new unscheduled SP. The AP transmits frames destined for the non-AP STA and associated with delivery-enabled ACs during an unscheduled SP. The bit for AID 0 (zero) in the bitmap control field of the TIM IE shall be set to 1 when non-MRG-SP group addressed~~broadcast or multicast~~ traffic is buffered, according to 7.3.2.6.
2. All ~~broadcast/multicast~~non-MRG-SP group addressed MSDUs, with the Order bit in the Frame Control field clear, shall be buffered if any associated STAs are in PS mode.
3. When dot11MgmtOptionFMSActivated is false, immediately after every DTIM, the AP shall transmit all buffered non-MRG-SP group addressed MSDUs.

When dot11MgmtOptionFMSActivated is true and the AP has established an FMS delivery interval for a multicast stream, the AP shall transmit all non-MRG-SP group addressed frames belonging to particular FMS stream immediately after the DTIM that has the Current Count field value of the FMS Counter field set to 0 for that particular FMS stream.

The More Data field of each group addressed frame shall be set to 1 to indicate the presence of further buffered non-MRG-SP group addressed MSDUs. If the AP is unable to transmit all of the buffered non-MRG-SP group addressed MSDUs before the TBTT following the DTIM, the AP shall set the bit for AID 0 (zero) in the TIM element to 1 for a single BSSID or set the corresponding group address bit to 1 for multiple BSSIDs as defined in 7.3.2.6, and when dot11MgmtOptionFMSActivated is true, shall set the appropriate bits in the FMS Descriptor information element as described in 7.3.2.75 to indicate for which non-MRG-SP group addresses there are still buffered frames, until all buffered non-MRG-SP group addressed frames have been transmitted.

When the AP transmits an STBC DTIM or TIM Beacon frame, the AP shall retransmit all non-MRG-SP group addressed frames that were transmitted following the non-STBC DTIM or TIM Beacon frame except that they are transmitted using the basic STBC MCS. It may be the case that a complete set of buffered non-MRG-SP group addressed frames is sent over a period of time during which non-STBC and STBC transmissions are interleaved, but the transition from non-STBC group addressed transmissions to STBC group addressed transmissions shall be preceded by the transmission of an STBC Beacon frame and the transition from STBC group addressed transmissions to non-STBC group addressed transmissions shall be preceded by the transmission of a non-STBC Beacon frame.

11.2.1.6 AP operation during the CFP

Change list items d), e) and f) of 11.2.1.6 as follows:

EDITORIAL NOTE—the following change is based on P802.11v\_D14.0.

1. All non-MRG-SP group addressed MSDUs with the Order bit in the Frame Control field clear, shall be buffered if any associated STAs are in the PS mode, whether those STAs are CF-Pollable or not.
2. When dot11MgmtOptionFMSActivated is false , immediately after every DTIM (Beacon frame with DTIM Count field of the TIM element equal to zero), the AP shall transmit all buffered non-MRG-SP group addressed frames.

When dot11MgmtOptionFMSActivated is true and the AP has set up an FMS delivery interval for a multicast stream, the AP shall send all non-MRG-SP group addressed frames belonging to a particular FMS stream immediately after the DTIM with the Current Count field value of the FMS Counter field set to 0 for that particular FMS stream.

The More Data field shall be set to indicate the presence of further buffered non-MRG-SP group addressed MSDUs. If the AP is unable to transmit all of the buffered non-MRG-SP group addressed MSDUs before the non-STBC or STBC TBTT following the DTIM, AP shall set the bit for AID 0 in the TIM element to 1 for a single BSSID or set the corresponding group addressed bit to 1 for multiple BSSIDs, as defined in 7.3.2.6, and when dot11MgmtOptionFMSActivated is true, shall set the appropriate bits in the FMS Descriptor information element as described in 7.3.2.75 to indicate for which non-MRG-SP group addresses there are still buffered frames, until all buffered non-MRG-SP group addressed frames have been transmitted.

When the AP transmits an STBC DTIM or TIM Beacon frame, the AP shall re-transmit all non-MRG-SP group addressed frames that were transmitted following the non-STBC DTIM or TIM Beacon frame except that they are transmitted using the basic STBC MCS. It may be the case that a complete set of buffered non-MRG-SP group addressed frames is sent over a period of time during which non-STBC and STBC transmissions are interleaved, but the transition from non-STBC group addressed transmissions to STBC group addressed transmissions shall be preceded by the transmission of a STBC Beacon frame and the transition from STBC group addressed transmissions to non-STBC group addressed transmissions shall be preceded by the transmission of a non-STBC Beacon frame.

1. Buffered MSDUs, A-MSDUs or MMPDUs for STAs in the PS mode shall be forwarded to the CF-Pollable STAs under control of the PC. Transmission of these buffered MSDUs or management frames as well as CF-Polls to STAs in the PS mode that were indicated in the DTIM in accordance with paragraph c) of this subclause shall begin immediately after transmission of buffered non-MRG-SP group addressed frames (if any), and shall occur in order by increasing AID of CF-Pollable STAs. A CF-Pollable STA for which the TIM element of the most recent beacon indicated buffered MSDUs or management frames shall be in the Awake state at least until the receipt of a directed frame from the AP in which the Frame Control field does not indicate the existence of more buffered MSDUs, A-MSDUs or management frames. After acknowledging the last of the buffered MSDUs, A-MSDUs or management frames, the CF-Pollable STA operating in the PS mode may enter the Doze state until the next DTIM is expected.

(#738)

11.22 Wireless network management procedures

11.22.15 Directed Multicast Service and More Reliable Groupcast ~~DMS Procedure~~

11.22.15.1 DMS Procedures

EDITORIAL NOTE—the following change is based on P802.11v\_D14.0.

Change the second paragraph of 11.22.15.1 as follows

Implementation of DMS is optional for a WNM STA and mandatory for a Robust AV Streaming STA. A STA that implements DMS has the MIB attribute dot11MgmtOptionDMSImplemented set to true. When dot11MgmtOptionDMSImplemented is true, at least one of dot11WirelessManagementImplemented and dot11RobustAVStreamingImplemented(#29) shall be true, and dot11HighThroughputOptionImplemented shall be true. A STA that has a value of true for the MIB attribute dot11MgmtOptionDMSActivated is defined as a STA that supports Directed Multicast. A STA for which the MIB attribute dot11MgmtOptionDMSActivated is true shall set the DMS field of the Extended Capabilities information element to 1.

Insert the following subclauses at the end of 11.22.15

11.22.15.2 MRG Procedures

11.22.15.2.1 Overview

More Reliable Groupcast (MRG) is a flexible service to improve the delivery of group addressed frames while optimizing for a range of criteria. MRG is an extension of DMS (11.22.15.1). In particular:

1. an MRG agreement applies to a single group address whereas a DMS flow is defined by TCLAS information element(s) and an optional TCLAS Processing information element, and
2. DMS offers multicast-to-unicast conversion only whereas MRG includes a superset of Ack policies and Delivery methods(#2).

MRG employs the DMS Request and DMS Response elements modified by MRG Request and Response subelements respectively for administering the set up and tear down of MRG services between an AP and non-AP STAs. The DMS procedures and state machine of shall apply to MRG with the extensions and constraints specific to MRG described below in to .

MRG defines two additional retransmission(#961) policies for group addressed frames, in addition to the mechanisms defined in (labeled “No-Ack/No-Retry” or “non-MRG”), and 11.22.15.1(#588) (labeled (#960)DMS):

* MRG-Unsolicited-Retry
* MRG-Block-Ack

(#773)(#774)When using the MRG-Unsolicited-Retry delivery method for a group address, the AP retransmits an MSDU one or more times to increase the probability of correct reception of associated STAs that are listening to this group address. How and when an AP chooses to retransmit these MSDUs is an implementation decision.

(#733)MRG-Block-Ack extends the block acknowledgement mechanism to group addresses. The AP initiates block Ack agreements with each associated STA that supports MRG-Block-Ack for a particular group address. Once this block Ack agreement is in place, the AP regularly sends BlockAckRequest frames to these STAs to ascertain the reception status of MSDUs related to this group address. This allows the AP to discover MSDUs that have failed to be received and to schedule their retransmission.

DMS(#960) allows the transmission of group addressed MSDUs as individually addressed A-MSDUs. It has low efficiency and scalability, and high delay (if there are multiple group members) and high reliability. MRG-Unsolicited-Retry allows unsolicited retries. It has moderate delay, efficiency and reliability, but high scalability. MRG-Block-Ack has moderate delay, high efficiency, scalability and reliability.

Two delivery methods(#2) for group addressed frames are used by the MRG service(#962):

* As per (labeled “Active -PS(#187)”) or FMS (see 11.2.1.4a) (collectively labeled “non-MRG-SP”)
* MRG-SP (see )

MRG-SP transmits MRG group addressed frames (#589)at regular intervals(#589). Compared to non-MRG-SP, MRG-SP has lower delay and jitter and moderate power savings.

11.22.15.2.1a MRG Group Membership Procedures(#855)

The procuedures described in clauses 11.22.15.2.2 to 11.22.15.2.7 depend upon the AP knowing the membership of the multicast groups of its associated STAs that support MRG.

One method for an AP to discover the multicast groups to which its associated STAs are receiving is to use the Group Membership Request frame (as defined in 7.4.7.aa22) to periodically request the contents of the dot11GroupAddressesTable of its associated STAs.

Another method for an AP to discover the multicast groups to which its associated STAs are receiving is to use the information transmitted by an associated STAs that send unsolicited Group Membership Response frames (as defined in 7.4.7.aa23).

Other methods of group membership detection are also possible, using information that is outside the scope of this standard. For example group membership detection could be achieved via IGMP snooping.

An associated STA for which dot11MRGActivated is true shall reply to a Group Membership Request frame by sending a Group Membership Response frame with the dialog token field set to the value from the Group Membership Request frame, the Address Count field set to the number of entries in dot11GroupAddressesTable and the Group Address List field set to the group MAC addresses in the dot11GroupAddressesTable.

An associated STA for which dot11MRGActivated is true should send a Group Membership Response frame with the dialog token field set to 0, the Address Count field set to the number of entries in dot11GroupAddressesTable and the Group Address List field set to the group MAC addresses in the dot11GroupAddressesTable, after association and every time the contents of the dot11GroupAddressesTable is modified.

11.22.15.2.2 MRG Setup(#199) Procedures

If an AP for which dot11MRGActivated is true(#590) detects that a non-AP STA with Robust AV Streaming set to 1 in the Extended Capabilities element in the non-AP STA’s most recent (Re)Association Request is a receiving one or more group addresses for which there is an active(#775) MRG service(#775) and it does not have an MRG agreement for the group(s), then the AP may alert the non-AP STA by sending an unsolicited individually addressed DMS Response frame that contains one DMS Status field with an MRG Response subelement per group address(#775). Each DMS Status field includes a TCLAS element to identify the group address, the DMSID corresponding to this MRG traffic flow, and other associated parameters. The Status field of this DMS Status field shall be set to “MRG Advertise”. The non-AP STA may choose to ignore the DMS Response frame, or to initiate an MRG agreement for one or more of the group addresses.

(#855)

A non-AP STA may request use of the MRG service for a group address by sending a DMS Descriptor as described in with the following modifications: (#742)

* (#562)The DMS Descriptor shall contain one TCLAS element with Frame classifier type equal to 0 (Ethernet parameters)(#759), one TSPEC element and one MRG Request subelement.
* The DMS Descriptor may contain other TCLAS elements in addition to the mandatory TCLAS element (that has a Frame classifier type equal to 0).(#759)
* When there are multiple TCLAS elements, a TCLAS processing element shall be present. Otherwise no TCLAS processing elements shall be present in the DMS Descriptor.(#759)
* (#562)The TSID subfield within the TS Info field of the TSPEC element shall be reserved. Since the AP may choose a Delivery method(#2) of MRG-SP, the non-AP STA should set the Minimum Service Interval, Maximum Service Interval and Service Start Time fields in the TSPEC to indicate the STA’s preferred wake-up schedule.
* (#562)The MRG Request subelement specifies the Retransmission(#961) policy and a Delivery method(#2) requested by the non-AP STA for the group addressed stream. The Retransmission(#961) policy field shall not be set to “No Preference”(#665). The Delivery method field shall not be set to “No Preference”(#664)

A non-AP STA shall not request (#195)transmission of a group address via MRG-Block-Ack or MRG-Unsolicited-Retry(#964) while it has an active DMS service for this group address. A non-AP STA shall not request transmission of a group address via DMS and while it has an active MRG service for this group address.(#195)

An AP accepts an MRG request by sending a DMS Status field with the Status field set to “Accept” as described in with the following modifications:

* (#562)The DMS Status field shall include an MRG Response subelement indicating the Retransmission(#961) policy and Delivery method(#2) for the group addressed stream.
* (#562)If the MRG group address stream is subject to the MRG-SP Delivery method(#2), then the AP shall also include a Schedule element in the DMS Status field indicating the wake-up schedule for the group address stream.

For each MRG Request subelement, the AP may adopt the requested Retransmission(#961) policy and Delivery method(#2), maintain its existing Retransmission(#961) policy and Delivery method(#2), select an alternate Retransmission(#961) policy and Delivery method(#2) or deny MRG service for the group addressed stream.

The Retransmission(#961) policy shall not be MRG-Block-Ack for an MRG group address while the AP has an MRG agreement for the group address with a non-AP STA that(#688) had the Advanced MRG field set to 0 in the Extended Capabilities element in the (Re)Association Request most recently received by the AP.

An AP denies an MRG request by sending a DMS Status field with the Status field set to “Deny” as described in with the following modifications:

* (#562)The DMS Status field shall include an empty MRG Response subelement

The AP shall not reject a Reassociation Request for the reason that one or more MRG Service requests are denied.

If the non-AP STA determines that one or more MRG Response subelements are unacceptable, then the non-AP STA shall discard any received ADDBA request frames for the unacceptable MRG streams and the non-AP STA shall send a new DMS Request frame containing a DMS Request element with one DMS Descriptor for each unacceptable MRG stream. The DMSID fields shall be set to the DMSIDs of the unacceptable streams and the Request Type field shall be set to “Remove”.







For each group addressed stream requested by the non-AP STA, the AP shall immediately initiate a Block Ack negotiation(Ed) if all the following conditions are true:

* (#562)The AP advertised an Advanced MRG field set to 1 in its Extended Capabilities element
* (#562)The non-AP STA advertised an Advanced MRG field set to 1 in the Extended Capabilities element in the Reassociation Request most recently received by the AP.

If all the above conditions are true(Ed) the AP shall immediately initiate a Block Ack negotiation by sending an ADDBA Request frame to the non-AP STA that originated the MRG request. The Block Ack Policy field in the Block Ack Parameter field within the ADDBA frames shall not be set to 0 (for delayed Block Ack). Non-AP STAs shall maintain this Block Agreement for the duration of their MRG agreement, irrespective of whether the MRG-Block-Ack is the current Retransmission(#961) policy or not. While the Retransmission(#961) policy of the MRG group address stream is DMS (#944) the non-AP STA shall suspend its Block Ack processing for the group addressed stream.

NOTE-Having a Block Ack agreement with all members of an MRG group address allows the AP to change the MRG Retransmission(#961) policy dynamically irrespective of the current MRG Retransmission(#961) policy.

An MRG agreement between a non-AP STA and an AP shall begin when the AP successfully transmits an individually addressed DMS Response frame with a DMS Response element containing a DMS Status field that has the Status field set to “Accept” as described in 11.22.15.1 with the following modification:

* (#562)The DMS Status field shall include an MRG Response subelement

11.22.15.2.2a MRG Frame Exchange Procedures(#199)

An MRG-Block-Ack agreement exists between a non-AP STA and an AP for a group addressed stream from when the non-AP STA successfully transmits an ADDBA Response frame until either the AP or non-AP STA successfully transmits a DELBA frame to the other party, or this MRG-Block-Ack agreement expires (see 9.10.5), or the MRG agreement no longer exists.

An AP may transmit a group address stream via the No-Ack/No-Retry (non-MRG; see ) service and MRG service simultaneously. The AP shall transmit each frame via the No-Ack/No-Retry Ack policy before it transmits the frame via the MRG service. An AP shall not simultaneously transmit a group address stream via more than one of the MRG-Unsolicited-Retry, MRG-Block-Ack, MRG-Block-Ack or MRG-Unsolicited-Retry delivery modes, but may switch dynamically between these modes as described in this clause.(#173)

An AP shall transmit a frame belonging to a group address via the MRG service if an associated non-AP STA has an MRG agreement for the group address, and otherwise does not transmit the frame via the MRG service.

An AP shall transmit a frame belonging to a group address via the No-Ack/No-Retry service if:

* (#562)There is at least one non-AP STA within the BSS with dot11RobustAVStreamingImplemented(#29) equal to false or without an MRG agreement for the group address, and
* (#562)Either
  + (#562)The group address is the broadcast address or
  + (#562)The group address is not the broadcast address and at least one of these non-AP STAs has been determined by the AP to be a member of the group address. How this determination is made is out of scope of this standard.

NOTE-IGMP snooping is commonly use to determine group address membership.

To avoid undetected retries being passed up at a receiver’s MAC-SAP, duplicate detection and removal(#477) for group addressed frames is required in STAs with dot11RobustAVStreamingImplemented(#29) set to true (see ).

MRG frames shall be QoS data frames (with QoS subfield of the Subtype field set to 1).

If the Block Ack agreement is successfully established for the group addressed stream and the Delivery method(#2) for the group addressed stream is MRG-SP, then the non-AP STA ensures it is awake for subsequent SPs (see ).

A non-AP STA may request a change of MRG service for a grouped addressed stream by sending a DMS Descriptor with the DMSID identifying the group address and the Request Type set to “Change” as described in with the following modifications:

* (#562)The DMS Descriptor shall contain zero TCLAS elements, zero TCLAS Processing elements, one TSPEC element and one MRG Request subelement.
* (#562)The TSPEC element and MRG Request subelement of this DMS Descriptor shall together contain at least one field that is different from the original TSPEC element and MRG Request subelement identified by the DMSID

The AP may update the Retransmission(#961) policy, Delivery method(#2), and Schedule as the size of the group changes, the capabilities of the members of the group change, MRG Request subelements for the group are received, Multicast Diagnostics or for any other reason. The AP advertises the current settings upon a change and periodically by(#196):

* Transmitting an unsolicited DMS Response frame with the current settings addressed to the broadcast address. This DMS Response frame shall be scheduled for delivery at the appropriate DTIM interval or SP where all non-AP STAs within the group are awake to receive the frame. One TCLAS element, one TSPEC element and one MRG Subselement shall be included per DMS Descriptor in the DMS Response element of the DMS Response frame to identify each MRG stream. The DMSID that identifies the MRG stream shall be included the DMS Descriptor. Each Status field in the DMS Status fields included in the frame shall be set to MRG Advertise.
* Transmitting an unsolicited DMS Response frame with the current settings addressed to the MRG group address. This DMS Response frame shall be scheduled for delivery at the appropriate DTIM interval or SP where all non-AP STAs within the group are awake to receive the frame. One TCLAS element, one TSPEC element and one MRG Subselement shall be included per DMS Descriptor in the DMS Response element of the DMS Response frame to identify each MRG stream. The DMSID that identifies the MRG stream shall be included the DMS Descriptor. Each Status field in the DMS Status fields included in the frame shall be set to MRG Advertise.
* Transmitting unsolicited DMS Response frames with the current settings individually addressed to each MRG group member. The DMSID shall be included in per DMS Descriptor in the DMS Response element of the DMS Response frame to identify each MRG stream. No TCLAS element, no TSPEC element and no MRG Subselement shall be included in these DMS Descriptors. Each Status field in the DMS Status fields included in the frame shall be set to MRG Advertise.

Non-AP STAs shall recover from missing group addressed MRG Response frames that advertise a changed Retransmission(#961) policy or Delivery method(#2) according to Table 11-aa1 or Table 11-aa2, respectively.

(#777)

Table 11-aa1: Non-AP STA recovery procedures for a changed Retransmission(#961) policy

|  |  |  |
| --- | --- | --- |
| Current retransmission(#961) policy state at non-AP STA(#743) | Retransmission(#961) policy being used by the AP | Recovery procedure(#203) |
| MRG | No-Ack/No-Retry | A non-AP STA  assumes that the MRG service has been deleted when no frames for the group address are received via the MRG service after a period of dot11MRGPolicyChangeTimeout(#197) |
| DMS(#960) | MRG-Unsolicited-Retry or MRG-Block-Ack | A non-AP STA shall update its current Retransmission(#961) policy of the MRG stream to MRG-Unsolicited-Retry(#200) upon receiving an MSDU for the DMS group address concealed via the MRG Concealment address. |
| MRG-Unsolicited-Retry or MRG-Block-Ack | DMS(#960) | A non-AP STA shall update its current Retransmission(#961) policy of the MRG stream to DMS upon receiving an MSDU for the MRG group address with an RA field that contains the non-AP STA’s individual address.(#201) |
| MRG-Unsolicited-Retry | MRG-Block-Ack | A non-AP STA shall update its current Retransmission(#961) policy of the MRG stream to MRG-Block-Ack upon receiving a BlockAckReq frame with an MRG Group Address subfield set to the MRG group address |
| MRG-Block-Ack | MRG-Unsolicited-Retry | A non-AP STA shall update its current Retransmission(#961) policy of the MRG stream to MRG-Unsolicited-Retry if MSDUs for the MRG group address concealed via the MRG Concealment address are being received yet no BlockAckReq frames for the MRG group address are received when the block ack agreement timeout occurs. |

Table 11-aa2: Non-AP STA recovery procedures for a changed Delivery method(#2)

|  |  |  |
| --- | --- | --- |
| Current Delivery method(#2) state at non-AP STA(#743) | Delivery method(#2) being used by the AP | Recovery procedure(#203) |
| Non-MRG-SP | MRG-SP | A non-AP STA shall update the current Power Management mode of the MRG stream to MRG-SP if   1. no frames with the More field set to 1 for the MRG stream are received for a period of dot11MRGPolicyChangeTimeout(#197), and 2. at least one frame for the MRG stream with the More field set to 0 is received.   Note: Upon detecting condition a), the STA should enter the Awake state in order to assist with detecting condition b). |
| MRG-SP | Non-MRG-SP | A non-AP STA shall update the current Power Management mode of the MRG stream to Non-MRG-SP if   1. no frames with the More field set to 0 for the MRG stream are received for a period of dot11MRGPolicyChangeTimeout,(#197) and 2. at least one frame for the MRG stream with the More field set to 1 is received. |

11.22.15.2.3 Concealment of MRG transmissions

Concealment prevents group addressed frames transmitted via the MRG-Unsolicited-Retry or MRG-Block-Ack retransmission(#961) policies from being passed up the MAC-SAP of MRG-incapable STAs.

MRG group addresses MSDUs transmitted via the MRG-Unsolicited-Retry or MRG-Block-Ack Ack policies shall be sent in an A-MSDU frame format with the RA set to the MRG Concealment address: <group-address(#636)-To-be-assigned-by-ANA>. The DA field in the A-MSDU subframe shall contain the group address of the MRG group that is being concealed (i.e. the same value as the DA field for non-MRG group addressed delivery).(#202)

A STA with dot11RobustAVStreamingImplemented(#29) set to true shall not use the MRG Concealment address for any purpose other than the transmission of MRG streams.

A STA with dot11RobustAVStreamingImplemented(#29) set to true and at least one MRG agreement shall add the MRG Concealment address to the STA’s dot11GroupAddressesTable.

(#960)

11.22.15.2.5 MRG-Unsolicited-Retry

A STA supports the MRG-Unsolicited-Retry Retransmission(#961) policy if dot11RobustAVStreamingImplemented(#29) is true; otherwise the STA does not support the MRG service with Retransmission(#961) policy equal to MRG-Unsolicited-Retry.

An AP adopting the MRG-Unsolicited Retry Retransmission(#961) policy for an MRG group address chooses a lifetime limit for the group address. The AP may vary the lifetime limit for the group address at any time, and may use lifetime limits for different MRG group addresses. An AP adopting the MRG-Unsolicited-Retry Retransmission(#961) policy for a MRG group address shall transmit each MSDU according to , subject to the lifetime limit. Transmission uses the backoff procedure described in .

If a Block Ack agreement has successfully been established for a group addressed stream that is delivered using the MRG-Unsolicited-Retry Retransmission(#961) policy, the STA shall follow the duplicate detection procedures defined in 9.2.9 and 9.10.4.(#944)

11.22.15.2.6 MRG-Block-Ack

A STA supports the MRG-Block-Ack Retransmission(#961) policy if both dot11RobustAVStreamingImplemented(#29) and dot11MRGImplemented (#16) are true; otherwise the STA does not support the MRG service with Retransmission(#961) policy equal to MRG-Block-Ack.

MRG Buffer Size for a group address is defined to equal to the minimum Buffer Size field in the Block Ack Parameter Set field in the last received ADDBA.response for that group address across members of the MRG group (see ).

11.22.15.2.7 MRG-SP

The MRG-SP delivery method transmits MRG group addressed frames at regular intervals.(#875)

A STA supports the MRG-SP delivery method(#2) if dot11RobustAVStreamingImplemented(#29) is true; otherwise the STA does not support the MRG service with Delivery method(#2) equal to MRG-SP.

NOTE-Group addressed traffic transmitted at the end of a DTIM beacon can be an impediment to providing QoS for uplink transmissions and in overlapping BSSs. Therefore APs in an overlapped environment are advised to make use of MRG-SP for group address traffic that consumes appreciable medium time.

A group addressed(#334) MSDUs shall not be transmitted via the MRG-SP Power Management policy if either the Active -PS(#187) or FMS Delivery methods(#2) are active for that group address.

An AP advertises that a group address stream is subject to MRG-SP within an MRG Response subelement. The subelement indicates the start of each Service Period. See . At every scheduled SP, the AP schedules for transmission buffered MRG-SP group addressed frames assigned to that particular group address.

An AP shall only accept either an MRG-SP or an FMS agreement for a group address stream from a single non-AP STA.

An AP shall not use the MRG-SP delivery method for an accepted DMS service when the non-AP STA that requested the DMS service has the Robust AV Streaming bit in the Extended Capabilities element set to 0.(#960)

Annex A

A.4 PICS proforma–IEEE Std. 802.11, 2007 Edition

A.4.23 RobustAVT extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Protocol Capability | References | Status | Support |
| AVT1 | Extended Capabilities information element |  | CFaa:M | Yes, No, N/A |
| AVT2  AVT2.1 | More Reliable Groupcast  Advanced MRG | 9.2.7.3  ,  11.22.15.2.5,  11.22.15.2.6,  11.22.15.2.7(#979) | CFaa: M  (CFaa and QB5)(#957): O | Yes, No, N/A  Yes, No, N/A |
| AVT3 | Alternate EDCA transmit queues |  | CFaa:O | Yes, No, N/A |
| AVT4  AVT4.1  AVT4.2 | Stream Classification Service  SCS Request frame(Ed)  SCS Response frame(Ed) | (Ed)  (Ed)  (Ed) | CFaa:O  AVT4:M  AVT4:M | Yes, No, N/A  Yes, No, N/A  Yes, No, N/A |
| ATV5(#369) | OBSS Management | (Ed) | CFaa:M | Yes, No, N/A |
| ATV6(#369)  AVT6.1  AVT6.2  AVT6.3 | QLoad Report  QLoad Report element  QLoad Request frame  QLoad Report frame | (Ed)  (Ed)  (Ed)  (Ed) | (AVT5 and CF1):M  AVT6:M(#57)  AVT6:M  AVT6:M | Yes, No, N/A  Yes, No, N/A  Yes, No, N/A  Yes, No, N/A |
| AVT7(#369)  AVT7.1 | HCCA TXOP Advertisement element  HCCA TXOP Negotiation | , (Ed)  (Ed) | (AVT5:M and QP1):M  AVT7:O(#308) | Yes, No, N/A  Yes, No, N/A |

Annex D

**ASN.1 encoding of the MAC and PHY MIB**

-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

-- \* dotStationConfig TABLE

-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Dot11StationConfigEntry ::=

SEQUENCE {

dot11StationID MacAddress,

dot11MediumOccupancyLimit INTEGER,

dot11CFPollable TruthValue,

dot11CFPeriod INTEGER,

dot11CFPMaxDuration INTEGER,

dot11AuthenticationResponseTimeOut Unsigned32,

dot11PrivacyOptionImplemented TruthValue,

dot11PowerManagementMode INTEGER,

dot11DesiredSSID OCTET STRING,

dot11DesiredBSSType INTEGER,

dot11OperationalRateSet OCTET STRING,

dot11BeaconPeriod INTEGER,

dot11DTIMPeriod INTEGER,

dot11AssociationResponseTimeOut Unsigned32,

dot11DisassociateReason INTEGER,

dot11DisassociateStation MacAddress,

dot11DeauthenticateReason INTEGER,

dot11DeauthenticateStation MacAddress,

dot11AuthenticateFailStatus INTEGER,

dot11AuthenticateFailStation MacAddress,

dot11MultiDomainCapabilityImplemented TruthValue,

dot11MultiDomainCapabilityEnabled TruthValue,

dot11CountryString OCTET STRING,

dot11SpectrumManagementImplemented TruthValue,

dot11SpectrumManagementRequired TruthValue,

dot11RSNAOptionImplemented TruthValue,

dot11RSNAPreauthenticationImplemented TruthValue,

dot11RegulatoryClassesImplemented TruthValue,

dot11RegulatoryClassesRequired TruthValue,

dot11QosOptionImplemented TruthValue,

dot11ImmediateBlockAckOptionImplemented TruthValue,

dot11DelayedBlockAckOptionImplemented TruthValue,

dot11DirectOptionImplemented TruthValue,

dot11APSDOptionImplemented TruthValue,

dot11QAckOptionImplemented TruthValue,

dot11QBSSLoadOptionImplemented TruthValue,

dot11QueueRequestOptionImplemented TruthValue,

dot11TXOPRequestOptionImplemented TruthValue,

dot11MoreDataAckOptionImplemented TruthValue,

dot11AssociatedinNQBSS TruthValue,

dot11DLSAllowdInQBSS TruthValue,

dot11DLSAllowed TruthValue,

dot11AssociateStation MacAddress,

dot11AssociateID INTEGER,

dot11AssociateFailStation MacAddress,

dot11AssociateFailStatus INTEGER,

dot11ReassociateStation MacAddress,

dot11ReassociateID INTEGER,

dot11ReassociateFailStation MacAddress,

dot11ReassociateFailStatus INTEGER,

dot11RadioMeasurementCapable TruthValue,

dot11RadioMeasurementEnabled TruthValue,

dot11RRMMeasurementProbeDelay INTEGER,

dot11RRMMeasurementPilotPeriod INTEGER,

dot11RRMLinkMeasurementEnabled TruthValue,

dot11RRMNeighborReportEnabled TruthValue,

dot11RRMParallelMeasurementsEnabled TruthValue,

dot11RRMRepeatedMeasurementsEnabled TruthValue,

dot11RRMBeaconPassiveMeasurementEnabled TruthValue,

dot11RRMBeaconActiveMeasurementEnabled TruthValue,

dot11RRMBeaconTableMeasurementEnabled TruthValue,

dot11RRMBeaconMeasurementReportingConditionsEnabled TruthValue,

dot11RRMFrameMeasurementEnabled TruthValue,

dot11RRMChannelLoadMeasurementEnabled TruthValue,

dot11RRMNoiseHistogramMeasurementEnabled TruthValue

dot11RRMStatisticsMeasaurementEnabled TruthValue,

dot11RRMLCIMeasurementEnabled TruthValue,

dot11RRMLCIAzimuthEnabled TruthValue,

dot11RRMTransmitStreamCategoryMeasurementEnabled TruthValue,

dot11RRMTriggeredTransmitStreamCategoryMeasurementEnabled

TruthValue,

dot11RRMAPChannelReportEnabled TruthValue,

dot11RRMMIBEnabled TruthValue,

dot11RRMMaxMeasurementDuration Unsigned32,

dot11RRMNonOperatingChannelMaxMeasurementDuration Unsigned32,

dot11RRMMeasurementPilotTransmissionInformationEnabled TruthValue,

dot11RRMMeasurementPilotCapability Unsigned32,

dot11RRMNeighborReportTSFOffsetEnabled TruthValue,

dot11RRMRCPIMeasurementEnabled TruthValue,

dot11RRMRSNIMeasurementEnabled TruthValue,

dot11RRMBSSAverageAccessDelayEnabled TruthValue,

dot11RRMBSSAvailableAdmissionCapacityEnabled TruthValue,

dot11RRMAntennaInformationEnabled TruthValue,

dot11FastBSSTransitionImplemented TruthValue

dot11LCIDSEImplemented TruthValue,

dot11LCIDSERequired TruthValue,

dot11DSERequired TruthValue,

dot11ExtendedChannelSwitchEnabled TruthValue,

dot11RSNAProtectedManagementFramesEnabled TruthValue,

dot11RSNAUnprotectedManagementFramesAllowed TruthValue,

dot11AssociationPingResponseTimeout Unsigned32,

dot11AssociationMaximumPingAttempts INTEGER,

dot11HighThroughputOptionImplemented TruthValue,

dot11TunneledDirectLinkSetupImplemented TruthValue,

dot11TDLSPeerUAPSDImplemented TruthValue,

dot11TDLSPeerPSMImplemented TruthValue,

dot11TDLSPeerUAPSDIndicationWindow INTEGER,

dot11TDLSChannelSwitchingImplemented TruthValue,

dot11TDLSPeerSTAMissingAckRetryLimit INTEGER,

dot11TDLSResponseTimeout INTEGER,

dot11TDLSProbeDelay INTEGER,

dot11TDLSDiscoveryRequestWindow INTEGER, (Ed – 11z D13)

dot11TDLSACDeterminationInterval INTEGER, (Ed – 11z D13)

dot11RobustAVStreamingImplemented TruthValue,

dot11MRGImplemented TruthValue,

dot11SCSImplemented TruthValue,

dot11SCSActivated TruthValue,

dot11QLoadReportActivated TruthValue,

dot11QLoadReportIntervalDTIM INTEGER,

dot11AlternateEDCAActivated TruthValue,

(#245) dot11HCCATXOPNegotiationActivated TruthValue,(#308)

dot11HCCATXOPBeaconTimeout INTEGER(#117)

}

(#245)

dot11MRGPolicyChangeTimeout OBJECT-TYPE

SYNTAX INTEGER(0..65535)

UNITS "100 TUs"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This attribute indicates the interval after which a STA updates its

MRG delivery or recovery policy state using the procedures defined in

11.22.15.2.2a

"

DEFVAL { 0 }

::= { dot11StationConfigEntry aa?? }

**References:**