IEEE P802.11
Wireless LANs

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| LB170 GCR Comments |
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Abstract

This document contains all the normative text changes to resolve the comments from LB170 in the GCR category. Each text change has a (#CID) tag to indicate the comment to which the change relates. The first occurrence of the (#CID) tag will also have a Word comment attached to it, that contains the comment and the commenter’s proposed resolution, unless the resolution was “as in comment” when the resolution text is omitted from the comment.

Changes are based upon P802.11aa D2.0 and are shown using Word change tracking.

# 3. Definitions

**3.aa1 No retry/no acknowledgment**(#1211): A retransmission policy for group addressed frames in which each frame is transmitted once and without acknowledgement.

**3.aa2 Active from power save (Active-PS)**: A delivery method for group addressed frames whereby group addressed frames are transmitted when all associated non-access point (non-AP) stations (STAs) are in Active mode or after a DTIM(#1295) beacon that causes the associated non-AP stations that are in power save (PS) mode to be awake.

**3.aa3 Groupcast with Retries (GCR) service**: A means for transmission and retransmission of medium access control (MAC) service data units (MSDUs) to a destination that is a group address that provides greater reliability by using individually addressed (re)transmissions or(#1257) group addressed retransmissions(#1296), concealed from GCR-incapable stations.

**3.aa4 Groupcast with Retries (GCR) group address**: A group address subject to a GCR agreement between the access point (AP) and at least one station (STA) within the basic service set (BSS).

**3.aa5 Groupcast with Retries (GCR) frame**: A group addressed frame transmitted via the GCR service by an access point (AP).

**3.aa6 Groupcast with Retries (GCR) Service Period (GCR-SP) frame**: A frame subject to the GCR service when delivery method is GCR-SP.

**3.aa7 Groupcast with Retries (GCR) Service Period (GCR-SP) medium access control (MAC) service data unit (MSDU)**: An MSDU subject to the GCR service with delivery method equal to GCR-SP.

**3.aa8 Groupcast with Retries (GCR) Service Period (GCR-SP) aggregate medium access control (MAC) service data unit (A-MSDU)**: An A-MSDU subject to the GCR service with delivery method equal to GCR-SP.

**3.aa9 Active Groupcast with Retries (GCR) Service Period (GCR-SP)**: A delivery method for a group addressed stream subject to a GCR agreement wherein the frames are transmitted at regular intervals that might be less than the beacon interval(#1297).

**3.aa11 Groupcast with Retries (GCR) 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 purpose of transmitting multiple frames that are subject to the GCR service.

**Groupcast with Retries (GCR) concealment address:** A locally administered group medium access control (MAC) address that is used to prevent group addressed frames transmitted via the GCR-Unsolicited-Retry or GCR-Block-Ack retransmission policies from being passed up the MAC-service access point (MAC-SAP) of GCR-incapable stations.(#1298)

# 5. General description

## 5.2 Components of the IEEE 802.11 architecture

#### 5.2.aa12.1 Groupcast with Retries

The Groupcast with Retries (GCR) 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, 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

EDITORIAL NOTE⎯This is clause 5.1.1.5 in REVmb D6.0

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 group 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, then the MSDU is buffered for transmission and is also sent to the DS.

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 to be delivered via the GCR service(#1263).
* 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 group address unless the frame is to be delivered via the GCR service.

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 an individually addressed frame and is acknowledged by the STA.
* QoSNoAck, if the frame is a group addressed frame andor is not acknowledged by the STA.

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

NOTE— GCR frames are only transmitted by a QoS AP

# 7. Frame formats

## 7.1 MAC frame formats

### 7.1.3 Frame fields

EDITORIAL NOTE⎯This is clause 8.2.4 in REVmb D6.0

#### 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 group addressed frames transmitted by the AP when additional group addressed BUs that are not part of an active GCR-SP remain to be transmitted by the AP during this beacon interval. The More Data field is set to 0 in group addressed frames transmitted by the AP when no more group addressed BUs that are not part of an active GCR-SP remain to be transmitted by the AP during this beacon interval and in all 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 last paragraph of 7.1.3.4.1 as follows:

EDITORIAL NOTE: This is clause 8.2.4.4.2 in REVmb D6.0

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 when the MSDU (#1218)is delivered via both DMS and group addressed delivery (No-Ack/No-Retry, GCR-Unsolicited-Retry or GCR-Block-Ack retransmission policies)(#1264). In these cases(#1096) the sequence numbers assigned to the MSDUs (re)transmitted using group addressed delivery need not match the sequence number of the corresponding unicast MSDUs delivered via DMS(#1265)..

#### 7.1.3.5 QoS Control field

##### 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 is true then the HC sets the EOSP field to 1 in a GCR-SP group addressed frame in order to indicate that no more GCR-SP frames of that group address are to be transmitted by the AP until the next scheduled SP for this GCR-SP stream. The EOSP field is set to 0 in a group addressed frame delivered using the Active GCR-SP procedures described in 11.22.15.aa2.8.

## 7.2 Format of individual frame types

### 7.2.1 Control frames

#### 7.2.1.7 Block Ack Request (BlockAckReq) frame format

##### 7.2.1.7.1 Overview of the BlockAckReq frame format

(#1300)(#1266)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  | Frame Control | Duration / ID | RA | TA | BAR Control | BAR Information |  | FCS |
| Octets | 2 | 2 | 6 | 6 | 2 | Variable |  | 4 |
| Figure 7-12—BlockAckReq frame |

Change figure 7-13 as indicated

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B3 B4 | B11 | B12 | B15 |
|  | BAR Ack Policy | Multi-TID | Compressed Bitmap | GCR | Reserved | TID\_INFO |
| Bits | 1 | 1 | 1 | 1 | 8 | 4 |
| Figure 7-13—BAR Control field |

Change the seventh paragraph of 7.2.1.7.1 as indicated:

The values of the Multi-TID and Compressed Bitmap and GCR subfields determine which of threefour possible

BlockAckReq frame variants is represented, as indicated in Table 8-15 (BlockAckReq frame variant encoding)

Change Table 8-15 as indicated.(#1092)

|  |  |
| --- | --- |
|  | Table 8-15—BlockAckReq frame variant encoding |
| Multi-TID subfield value | Compressed Bitmap subfield value | GCR subfield value | BlockAckReq frame variant |
| 0 | 0 | 0 | Basic BlockAckReq |
| 0 | 1 | 0 | Compressed BlockAckReq |
| 1 | 0 | 0 | Reserved |
| 1 | 1 | 0 | Multi-TID BlockAckReq |
| 0 | 0 | 1 | Reserved |
| 0 | 1 | 1 | GCR BlockAckReq |
| 1 | 0 | 1 | Reserved |
| 1 | 1 | 1 | Reserved |

Insert the following text and Figure 7-aa2 at the end of 7.2.1.7.4.

##### 7.2.1.7.aa5 GCR BlockAckReq variant(#1092)

The TID\_INFO subfield of the BAR Control field of the GCR BlockAckReq frame contains the TID for which a BlockAck frame is requested.

The BAR Information field of the GCR BlockAckReq frame contains the Block Ack Starting Sequence Control subfield, as shown in Figure 7-aa2 (Block Ack Starting Sequence Control field). The Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield contains the sequence number of the first MSDU or A-MSDU for which this BlockAckReq frame is sent. The Fragment Number subfield of the Block Ack Starting Sequence Control subfield is set to 0.

.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Octets | 2 | 6 |
|  | Fragment Number | Starting Sequence Number | GCR Group Address |
| Bits | 4 | 12 | 48 |
| Figure 7-aa2—BAR Information field (GCR BlockAckReq) |

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

#### 7.2.1.8 Block Ack (BlockAck) frame format

##### 7.2.1.8.1 Overview of the BlockAck frame format

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
| Octets | 2 | 2 | 6 | 6 | 2 | Variable |  | 4 |
|  | Frame Control | Duration / ID | RA | TA | BA Control | BA Information |  | FCS |
| Figure 7-15—BlockAck frame |

Change Figure 7-16 as indicated:

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  | B0 | B1 | B2 | B3 | B3B4 | B11 | B12 | B15 |
|  | BA Ack Policy | Multi-TID | Compressed Bitmap | GCR | Reserved | TID\_INFO |
| Bits: | 1 | 1 | 1 | 1 | 9 8 | 4 |
| Figure 7-16—BA Control field |

|  |
| --- |
|  |

When the GCR field is set to 1, the BlockAck is sent in response to a BlockAckReq that has the GCR field set to 1 in the BAR Control Field.

Change the seventh paragraph of 7.2.1.8.1 as indicated:

The values of the Multi-TID, GCR and Compressed Bitmap subfields of the BA Control field determine which of three possible BlockAck frame variants is represented, as indicated in the Table 7-6k (BlockAck frame variant encoding).(#1092)

Change Table7-6k as indicated:

|  |
| --- |
| Table 7-6k—BlockAck frame variant encoding |
| Multi-TID subfield value | Compressed Bitmap subfield value | GCR | BlockAck frame variant |
| 0 | 0 | 0 | Basic BlockAck |
| 0 | 1 | 0 | Compressed BlockAck |
| 1 | 0 | 0 | Reserved |
| 1 | 1 | 0 | Multi-TID BlockAck |
| 0 | 0 | 1 | Reserved |
| 0 | 1 | 1 | GCR BlockAck |
| 1 | 0 | 1 | Reserved |
| 1 | 1 | 1 | Reserved |

 Insert the following paragraph after 7.2.1.8.4:

##### 7.2.1.8.aa5 GCR Block Ack Variant(#1092)(#1094)

The TID\_INFO subfield of the BA Control field of the GCR BlockAck frame contains the TID for which this BlockAck frame is sent.

The BA Information field of the GCR BlockAck frame comprises the Block Ack Starting Sequence Control subfield, GCR Group Address and the Block Ack Bitmap subfield, as shown in Figure 7-aa37. The Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield contains the sequence number of the first A-MSDU for which this BlockAck frame is sent. The value of this subfield is defined in 9.10.aa10. The Fragment Number subfield of the Block Ack Starting Sequence Control subfield is set to 0.

The GCR Group Address field is set to the value from the Group Address subfield of the GCR BAR Information field in the BlockAckReq frame that the BlockAck frame is sent in response to.

|  |
| --- |
|  |
| Octets: | 2 | 6 | 8 |
|  | Block Ack Starting Sequence Control | GCR Group Address | Block Ack Bitmap |
|  |  |  |  |
| Figure 7-aa37—BA Information field (GCR BlockAck) |

### 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 GCR 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 GCR 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 GCR frames as described in 11.22.15.aa2.5.

#### 7.3.1.16 DELBA Parameter Set field

Change Figure 7-34 with the following figure:

EDITORIAL NOTE—the change comprises adding DELBA GCR Group Address Present field from the former reserved field

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B10 B9 | B10 | B11 | B12 | B15 |
|  | Reserved | DELBA GCR Group Address Present | Initiator | TID |
| Bits: | 11 10 | 1 | 1 | 4 |
| Figure 7-34—DELBA Parameters fixed field |

Insert the following text at the end of 7.3.1.16:

If the DELBA GCR Group Address Present field is set to 1, then the DELBA GCR Group Address field is included in the DELBA Request frame; otherwise the DELBA GCR Group Address field is omitted from the DELBA Request frame.

Insert the following subclauses (7.3.1.aa31 and 7.3.1.aa32) at the end of 7.3.1:

#### 7.3.1.aa31 Extended Block Ack Parameter Set

The Extended Block Ack Parameter Set field is used in Extended(#1029) 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.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | B0 | B1 | B15 |
|  | ADDBA GCR Group Address Present | Reserved |
| Bits: | 1 | 15 |
| Figure 7-aa36— Extended Block Ack Parameter Set fixed field |

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

#### 7.3.2.27 Extended Capabilities information element

Insert the rows for Bit <ANA>, and change the Reserved row in Table 7-35a as follows (note that the entire table is not shown here):

EDITORIAL NOTE—The <ANA> will be replaced with a number assigned by the 802.11 Assigned Numbers Authority once that assignment has been made.

|  |
| --- |
| Table 7-35a—Capabilities field |
| Bit | Information | Notes |
| <ANA> | Robust AV Streaming | The STA sets the Robust AV Streaming field to 1 when the MIB attribute dot11RobustAVStreamingImplemented is true, and sets it to 0 otherwise. See 11.aa23.  |
| <ANA> | Advanced GCR | The STA sets the Advanced GCR field to 1 when the MIB attribute dot11GCRActivated is true , and sets it to 0 otherwise. See 11.22.15.aa2.(#1030) |
| <ANA> | SCS | The STA sets the SCS field to 1 when the MIB attribute dot11SCSActivated is true , and sets it to 0 otherwise. See 11.aa23.2 (SCS Procedures) |
| <ANA> | QLoad Report | When dot11QLoadReportActivated is true , the QLoad Report field is set to 1 to indicate the AP supports QLoad Report as described in 11.aa24.1 |
| <ANA> | Alternate EDCA | The STA sets the Alternate EDCA field to 1 when the MIB attribute dot11AlternateEDCAActivated is true , and sets it to 0 otherwise. See 9.1.3.1. |
| (<ANA>+1) —n\*8 | Reserved | All other bits are reserved, and are set to 0 on transmission and ignored on reception. |

#### 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 11.22.15.aa2(#1031) and 11.4. 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 GCR-SPReserved |
| 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 a GCR Request subelement(#1219) that has the GCR delivery method set to GCR-SP, a Minimum Service Interval field equal to 0 indicates that Service Periods up to the Maximum Service Interval are requested, including the continuous service period used by the Active GCR-SP delivery method.

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 a GCR Request subelement(#1220) that has the GCR delivery method set to GCR-SP, a Maximum Service Interval field equal to 0 indicates that the continuous service period used by the Active GCR-SP delivery method 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 areis 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 GCR-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 a Schedule element is sent within a GCR 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 GCR 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 a GCR Response element that has the GCR delivery method set to GCR-SP, a value of 0 in the Service Interval field indicates the delivery method is Active GCR-SP.

Change the seventh paragraph of 7.3.2.34 as follows:

The HC may set both the Service Start Time field and the Service Interval field to 0 (unspecified) for non-powersaving STAs, except when the Schedule element is included within a GCR Response subelement that has the GCR delivery method set to GCR-SP. When the Schedule element is included within a GCR Response subelement that has the GCR delivery method set to GCR-SP the Service Start Time field shall not be set to 0 and the Service Interval field may be set to 0.(#1269)

#### 7.3.2.88 DMS Request element

Change paragraphs 8, 9, and 10 of 7.3.2.88 as follows:

When the Request Type field is set to "Add", the TCLAS elements field contains one or more TCLAS information elements to specify group addressed frames as defined in 7.3.2.31. When a GCR 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 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.

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 a GCR 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 7-43bd as follows:

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

Insert the following paragraphs, figures and tables after Table 7-43bd and before paragraph 13.

Each DMS Descriptor contains zero or one GCR Request subelements. If present and the Request Type field is set to “Add” or “Change”, the GCR Request subelement indicates a request by a non-AP STA to its AP to respectively add or change the GCR service for a group address stream identified by the TCLAS information element or DMSID in the DMS Descriptor(#1270). The format of the GCR Request subelement is shown in Figure 7-aa3.

|  |  |  |  |
| --- | --- | --- | --- |
| Octets:(#1271) | 1 | 1 | 2 |
|  | Subelement ID | Length | GCR Retransmission Policy | GCR Delivery Method |
| Bits: | 8 | 8 | 4 | 4 |
| Figure 7-aa3—GCR Request subelement field |

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

The GCR Retransmission Policy field is set to indicate the non-AP STA’s preferred retransmission policy for the group address for which the GCR service is requested. The values are shown in Table 7-aa1.

|  |
| --- |
| Table 7-aa1— GCR Retransmission Policy field values |
| Value | GCR Retransmission Policy | Notes |
| 0 | No Preference |  |
| 1 | DMS | See 11.22.15.1 |
| 2 | GCR-Unsolicited-Retry | See 11.22.15.aa2.6 |
| 3 | GCR-Block-Ack | See 11.22.15.aa2.7 |
| 4-15(#1271) | Reserved |  |

The GCR Delivery Method field is set to indicate the non-AP STA’s preferred delivery method for the group address for which the GCR service is requested. The values are shown in Table 7-aa2.

|  |
| --- |
| Table 7-aa2— GCR Delivery Method field values |
| Value | GCR Delivery Method | Notes |
| 0 | No Preference |  |
| 1 | Active -PS or FMS |  |
| 2 | GCR-SP | See 11.22.15.aa2.8 |
| 3-15(#1271) | Reserved |  |

#### 7.3.2.89 DMS Response element

Change the fourth paragraph of 7.3.2.89 as follows:

The Response Type field indicates the response type 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 GCR service in the BSS, as indicated in Table 7-43be.

Change Table 7-43be as follows:

|  |
| --- |
| Table 7-43be—Response Type field values |
| Field value  | Description | Notes |
| 0 | Accept | AP accepts the DMS or GCR request |
| 1 | Denied | AP rejects the DMS or GCR request |
| 2 | Terminate | AP terminates the previously accepted DMS or GCR request |
| 3 | GCR Advertise | AP advertises a group addressed stream subject to an existing GCR agreement |
| 34-255 | Reserved |  |

 Change paragraphs10, 11, and 12 of 7.3.2.89 as follows:

When the Response Type(#1122) field is set to “Accept” or “Denied” and a GCR 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 Response Type(#1123) field is set to “Accept”, “Denied” or “GCR Advertise” and a GCR Response subelement is included in the DMS Status field, the TCLAS Elements field contains at least 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 Response Type(#1124) 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 Response Type(#1125) field is set to “Terminate” or when there is only one TCLAS information element, the TCLAS Processing Element field contains zero TCLAS Processing elements.

When the Response Type(#1126) 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 a GCR Response subelement is included in the DMS Status field and the Response(#1127) Type field value is set to “Accept”, “Denied” or “GCR 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 7-43bf as follows:

|  |
| --- |
| Table 7-43bf—Optional Subelement IDs for DMS Status |
| Subelement ID | Name | Length field(octets) | Extensible |
| 0-220 | Reserved |  |  |
| 1 | GCR Response | 1 to 22(#1272) | Subelements |
| 2-220 | Reserved |  |  |
| 221 | Vendor Specific | 3 to 248 |  |
| 222-255 | Reserved |  |  |

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

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

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  | Subelement ID | Length | GCR Retransmission Policy | GCR Delivery Method | GCR Concealment Address | Schedule element |
| Octets: | 1 | 1 | 0 or 1 | 0 or 1 | 0 or 6 | 0 or 14 |
| Figure 7-aa4—GCR Response subelement field |

The GCR Retransmission Policy, GCR Delivery Method, and GCR Concealment Address fields are present when the Response Type(#1128) field is not equal to Denied; otherwise they are omitted. The Schedule element field may be present when the Response Type field is not equal to Denied.(#1129)

The GCR Retransmission Policy field is set to indicate the current GCR retransmission policy selected by the AP for the group address for which the GCR service is requested. The values are shown in Table 7-aa1.

The GCR Delivery method field is set to indicate the current GCR Delivery method selected by the AP for the group address for which the GCR service is requested. The values are shown in Table 7-aa2

The GCR Concealment Address, when present, indicates the GCR concealment address.

The Schedule Element field is present if the GCR Delivery method field is equal to GCR-SP. It indicates the current SP schedule for the group addressed stream (see 7.3.2.34).

### 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 GCR group address. The Action field value associated with each frame format within the Block Ack category is defined in Table 7-54.

Insert Block Ack Action field values, 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):(#1284)

|  |
| --- |
| Table 7-54—Block Ack Action field values |
| Block Ack Action field values | Meaning |
| <ANA> | Extended ADDBA Request |
| <ANA> | Extended ADDBA Response |
| 35–255 | Reserved |

#### 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 Action field values |
| Order  | Information |
| 5 | DELBA GCR Group Address |

(#1285)Insert the following paragraphs at the end of 7.4.4.3:

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

Insert the following subclauses (7.4.4.aa4 and 7.4.4.aa5) after 7.4.4.3:

#### 7.4.4.aa4 Extended ADDBA Request frame format

An extended ADDBA Request frame is sent by an originator of Block Ack to another STA. The Action field of an Extended ADDBA Request frame contains the information shown in Table 7-aa8.

|  |
| --- |
| Table 7-aa8—Extended ADDBA Request frame Action field format |
| Order | Information |
| 1 | Category |
| 2 | Block Ack 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 GCR Group Address |

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

The Block Ack 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 7.3.1.aa31. If the ADDBA GCR 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 GCR 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 Extended ADDBA Response frame format

|  |
| --- |
| Table 7-aa9—Extended ADDBA Response frame Action field format |
| Order  | Information |
| 1 | Category |
| 2 | Block Ack 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 GCR Group Address |

The category field is set to 3 (representing Block Ack)

The Block Ack Action field is set to <ANA> (representing Extended ABBA 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 7.3.1.aa31. If the ADDBA GCR 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 GCR Group Address field is a 6 octet field equal to the group address for which a Block Ack agreement is requested.

# 9. MAC sublayer functional description

## 9.2 DCF

Change the eighth paragraph of 9.2 as follows:

Excepting MPDUs transmitted via the GCR service, Tthe 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 GCR service, the RTS may be used if it is directed to a STA within the GCR group (see 9.9.1.6.aa1 and 9.10.aa10). 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

Change clause 9.2.7 as follows:

In the absence of a PCF or use of the GCR 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 GCR 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, theThe 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 grouped addressed frames, except for: those frames in which the To DS field is 1.

* Those frames in which the To DS field is 1, or
* Group addressed frames transmitted via the GCR service.

### 9.2.9 Duplicate detection and recovery

Change the sixth(#1304) paragraphs of 9.2.9 as follows:

EDITORIAL NOTE: This is clause 9.3.2.11 in REVmb D6.0

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. QoS STAs with dot11MFQEnabled set to true shall also keep a cache of recently received <Address 2, AC, sequence-number, fragment-number> tuples from IMFQ frames for all STAs from which it has received IMFQ 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 (#1304) 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. A receiving STA with dot11MFQImplemented not present or set to false and with(#1109) dot11RobustAVStreamingImplemented not present or set to(#1110) false, may omit tuples obtained from group addressed frames from the cache. A receiving STA with dot11RobustAVStreamingImplemented set to(#1111) true, the receiving STA shall(#1289) keep a cache entry per <DA(#1137), TID, sequence-number> tuple for each group address subject to a GCR agreement. A receiving STA may omit tuples obtained from group addressed or ATIM frames from the cache. A receiving STA with dot11MFQImplemented set to true and with dot11RobustAVStreamingImplemented not present or set to false(#1136) shall omit tuples obtained from group addressed or ATIM frames from the cache.

Insert the following note at the end of 9.2.9:(#1039)

NOTE⎯Group addressed retransmissions of BUs use the same sequence number as the initial group addressed transmission of the BU. Unicast retransmissions of a 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 might differ between the group addressed and unicast transmissions of the same BU.

## 9.3 PCF

### 9.3.2 PCF access procedure

#### 9.3.2.1 Fundamental access

EDITORIAL NOTE: This is clause 9.4.3.2 in REVmb D6.0

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 group addressed MSDUs/MMPDUs that are not being delivered using the GCR-SP delivery method(#1308), the PC shall transmit these prior to any individually addressed MSDUs/MMPDUs.

#### 9.3.2.4 IFS

##### 9.3.2.4.4 PIFS

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:” insert the following item:

* An AP continuing to transmit in a GCR-Block-Ack TXOP after the failure to receive a BlockAck as described in 9.10.aa10

### 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 multicastgroup 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 buffered group addressed frames that are not delivered via the GCR-SP delivery mode shall be sent immediately after any Beacon frame containing a TIM element with a DTIM count field with a value of 0.

#### 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 of(#1139) an MPDU (as indicated by the More(#1104) Data field set to 0) that is delivered using the GCR-Unsolicited-Retry service (9.9.1.6.aa1).
* The non-final (re)transmission of an MPDU(#1041) that is delivered using the GCR-Unsolicited-Retry service (9.9.1.6.aa1)) is defined to be a failure.
* The final (re)transmissions an MPDU(#1041) that is delivered using the GCR-Unsolicited-Retry service (9.9.1.6.aa1) is defined as a successful transmission
* The recognition of anything else, including any other valid frame, shall be interpreted as failure of the MPDU transmission.

##### 9.9.1.6.aa1 Unsolicited retry procedure

When using the GCR-Unsolicited-Retry delivery method for a group address, the AP may retransmit an MPDU to increase the probability of correct reception at the(#1290) associated STAs that are listening to this group address (i.e. the group address is in their dot11GroupAddressTable). How an AP chooses which MPDUs to retransmit is an implementation decision and beyond the scope of this standard.

A protective mechanism (such as transmitting using HCCA CAP(#1292), RTS/CTS, setting the Duration fields in the first frame and response frames to update the NAVs of STAs in the BSS and OBSS(s) or another mechanism described in 9.13) should be used to reduce the probability of other STAs transmitting during the GCR TXOP.(#1291)

The TXOP initiation rules defined in 9.9.1.2 (EDCA TXOPs) and 9.9.2.2 (TXOP structure and timing) shall be used for initiating a GCR TXOP.

When transmitting MPDUs using the GCR service with retransmission policy equal to GCR-Unsolicited-Retry:

* Following a MAC protection exchange that includes a response frame, for all GCR-Unsolicited-Retry (#1101) retransmissions the STA shall either transmit the frames within a TXOP separated by SIFS or RIFS(#1231) (subject to TXOP limits) or invoke its backoff procedure as defined in 9.9.1.5(#1104). The STA shall not transmit an MPDU and a retransmission of the same MPDU within the same TXOP. The final frame transmitted within a GCR TXOP shall follow the backoff procedure defined in 9.9.1.5
* Without MAC protection or with MAC protection that lacks a response frame, for all transmissions the STA shall invoke the backoff procedure defined in 9.9.1.5 at the PHY-TXEND.confirm that follows the transmission of each unsolicited retry CGR MPDU using a value of CWmin[AC] for CW.(#1103)
* All retransmissions of an MPDU shall have the Retry field in the Frame Control field set to 1.(#1311)
* During a GCR TXOP, frames may be transmitted within the GCR TXOP that do not use the GCR-Unsolicited-Retry transmission policy(#1102)

### 9.9.2 HCCA

EDITORIAL NOTE: This is clause 9.19.3 in REVmb D6.0

Change the fifth paragraph of 9.9.2 as follows:

The HC shall perform delivery of buffered non-GCR-SP group addressed MSDUs/MMPDUs 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.

## 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 GCR 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 GCR service, one or more GCR 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 GCR-Block-Ack retransmission policy shall be the recipient’s unicast address. For GCR frames delivered using the GCR-Block-Ack retransmission policy, the RA field of the frames shall be the GCR concealment 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.

Change the fifth paragraph of 9.10.3 as follows: (#1119)

For frames that are not delivered using the GCR-Block-Ack retransmission policy, the The recipient shall maintain a Block Ack record consisting of originator address, TID, and a record of reordering buffer size indexed by the received MPDU sequence control value. This record holds the acknowledgment state of the data frames received from the originator. For frames that are delivered using the GCR-Block-Ack retransmission policy, the recipient shall maintain a Block Ack record consisting of the DA address from the A-MSDU subframe header, TID, and a record of reordering buffer size indexed by the received MPDU sequence control value. This record holds the acknowledgment state of the group addressed data frames received from the originator.

### 9.10.6 Selection of BlockAck and BlockAckReq variants(#1092)

Insert the following paragraph at the end of 9.10.6:

The GCR subfield of the BA Control field shall be set to 1 in all BlockAck and BlockAckReq frames sent from one Robust AV STA to another Robust AV STA when requesting and responding to a Block Ack agreement for a group address delivered using the GCR-Block-Ack retransmission policy and shall be set to 0 otherwise.(#1094)

Insert the following subclauses (9.10.aa10) after 9.10.9:

EDITORIAL NOTE: Clause 9.10.9 is clause 9.20.9 in REVmb D6.0

### 9.10.aa10 GCR Block Ack

#### 9.10.aa10.2 Introduction to GCR Block Ack

This subclause extends the Block Ack mechanism to group addressed frames that are subject to the GCR-Block-Ack retransmission policy.

#### 9.10.aa10.2 Scoreboard context control during GCR Block Ack(#1119)

For each GCR Block Ack agreement a recipient shall maintain a block acknowledgment record as defined in 9.10.3. This record includes a bitmap, indexed by sequence number; a 12-bit unsigned integer starting sequence number, WinStartR, representing the lowest sequence number position in the bitmap; a variable WinEndR; and the maximum transmission window size, WinSizeR, which is set to the smaller of 64 and the value of the Buffer Size field of the associated ADDBA Response frame that established the Block Ack agreement. WinEndR is defined as the highest sequence number in the current transmission window. A STA implementing GCR Block Ack agreement shall maintain the block acknowledgment record for that agreement according to the following rules:

1. At GCR Block Ack agreement establishment:
	1. *WinStartR* = *SSN* from the ADDBA Request frame that elicited the ADDBA Response frame that established the GCR Block Ack agreement.
	2. *WinEndR* = *WinStartR* + *WinSizeR* – 1.
2. For each received data MPDU that is related with a specific GCR Block Ack agreement, the block acknowledgment record for that agreement is modified as follows, where *SN* is the value of the Sequence Number subfield of the received data MPDU:
	1. If *WinStartR* ≤ *SN ≤ WinEndR*, set to 1 the bit in position *SN* within the bitmap.
	2. If *WinEndR* < *SN < WinStartR* +211,
		1. Set to 0 the bits corresponding to MPDUs with Sequence Number subfield values from *WinEndR*+1 to *SN* – 1.
		2. Set *WinStartR* = *SN* – *WinSizeR* + 1.
		3. Set *WinEndR* = *SN*.
		4. Set to 1 the bit at position *SN* in the bitmap.
	3. If *WinStartR* +211≤ *SN ≤ WinStartR*, make no changes to the record.
3. For each received BlockAckReq frame that is related with a specific GCR Block Ack agreement, the block acknowledgment record for that agreement is modified as follows, where *SSN* is the value from the Starting Sequence Number subfield of the received BlockAckReq frame:
	1. 1) If *WinStartR* < S*SN ≤ WinEndR*,
		1. Set *WinStartR* = *SSN.*
		2. Set to 0 the bits corresponding to MPDUs with Sequence Number subfield values from *WinEndR* + 1 through *WinStartR* + *WinSizeR* – 1.
		3. Set *WinEndR* = *WinStartR* + *WinSizeR* – 1.
	2. 2) If *WinEndR* < *SSN < WinStartR* +211,
4. Set *WinStartR* = *SSN.*
5. Set *WinEndR* = *WinStartR* + *WinSizeR* – 1.
6. Set to 0 bits the corresponding to MPDU with Sequence Number subfield values from WinStartR to WinEndR.
	1. If *WinStartR* +211≤ *SSN ≤ WinStartR*, make no changes to the record.

#### 9.10.aa10.3 GCR Block Ack BlockAckReq and BlockAck frame exchanges

A protective mechanism (such as transmitting an HCCA CAP, RTS/CTS, setting the Duration field in the first frame and response frames to update the NAVs of STAs in the BSS and OBSS(s) or another mechanism described in 9.13 and 9.2.5.4) should be used to reduce the probability of other STAs transmitting during the GCR TXOP. (#1090)(#1291)

An AP may transmit no more than GCR Buffer Size A-MSDUs(#1042) with RA set to a the GCR concealment(#1043) address and the DA field of the A-MSDU subframe set to the GCR group address when the retransmission Policy for that group address is GCR-Block-Ack before sending(#1091) a BlockAckReq to one of the STAs that has a GCR-Block-Ack agreement for this group address. Upon reception of the BlockAck, an AP may send a BlockAckRequest to another STA that has a Block-Ack agreement for this group address, and this process may be repeated multiple times. The AP should(#1095) not send a BlockAckReq to a STA with a MAC address that matches the SA in any of the MSDUs or A-MSDUs transmitted during the GCR TXOP, as this STA will have discarded all group addressed MPDUs transmitted by the AP that have the source address equal to their MAC address (see 9.2.7).(#1095)

(#1313)When a non-AP STA receives a BlockAckReq with the GCR Group Address subfield equal to a GCR group address, the non-AP STA shall transmit a BlockAck frame at a delay of SIFS after the BlockAckReq. The BlockAck acknowledges the STA’s reception status of the block of group addressed frames requested by the BlockAckReq frame. (#1119)



Figure 9-aa1: Example of a frame exchange with GCR-Block-Ack retransmission policy

Figure 9-aa1 shows an example of a frame exchange when the GCR Block-Ack retransmission policy is used. The AP sends several A-A-MSDUs(#1044) using the GCR-Block-Ack retransmission policy. The AP then sends a BlockAckRequest frame to group member 1 of the GCR group, waits for the BlockAck frame and then sends a BlockAckRequest to group member 2. After receiving the BlockAck frame from GCR group member 2, the AP determines if any A-MSDUs(#1044) need to be retransmitted and sends some more A-MSDUs(#1042) (some of which might be retransmissions of previous A-MSDUs(#1042)) using the GCR-Block-Ack retransmission policy .

BlockAckReq and BlockAck frames might be lost or incorrectly received by the intended recipients. (#1118)The process may be restarted by the AP transmitting an updated BlockAckReq with a new Block Ack Starting Sequence Control field if the data A-MSDUs(#1042) requested for acknowledgement in the BlockAckReq have reached their lifetime limit.

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, A-MSDUs(#1042) that need to be retransmitted.

An AP adopting the GCR-Block-Ack retransmission policy for a GCR 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 GCR group addresses. The AP transmits and retries each A-MSDU(#1042) until the appropriate lifetime limit is reached, or until each one has been received by all group members to which a BlockAckReq has been sent, whichever occurs first.

An AP may regularly send a BlockAckReq with the GCR Group Address subfield in the BAR Information field(#1092) set to the GCR group address and the Block Ack Starting Sequence Control set to the Sequence Number field of the earliest A-MSDU(#1042) of the GCR stream that has not been acknowledged by all group members and has(#1117) not expired due to lifetime limits, for GCR streams with retransmission policy equal to GCR-Block-Ack, in order to minimize buffering latency at receivers in the GCR group.

NOTE⎯This is because an AP might transmit management frames, QoS data frames with a group address in the Address 1 field (including different GCR 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 GCR streams with a GCR-Block-Ack retransmission policy since the cause of a hole in a receiver’s Block Ack bitmap is ambiguous: it is due either to an MPDU being lost from the GCR stream or to transmissions of MPDUs not related to the GCR service using the same sequence number counter.

The beginning of reception of an expected response to a BlockAckRequest(#1062) is detected by the occurrence of PHY-CCA. indication(BUSY,channel-list)(#1233) 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 the AP may perform error recovery by retransmitting a BlockAckReq frame PIFS after the previous BlockAckReq frame when both of the following conditions are met:

* The carrier 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
* The remaining duration of the GCR TXOP(#1063) is longer than the total time required to retransmit the GCR BlockAckReq plus one slot time.

NOTE⎯If an AP fails to receive a BlockAck frame in response to a BlockAckReq frame and there is insufficient time to transmit a recovery frame, the AP retransmits the BlockAckReq frame in a new TXOP.

# 10. Layer management

## 10.3 MLME SAP Interface

### 10.3.aa74 Group Membership management(#1001)

These set of primitives support the process of group membership requesting and reporting between an AP and its associated STAs as described in 11.22.15.aa2.2.

#### 10.3.aa74.1 MLME-GROUP-MEMBERSHIP.request

##### 10.3.aa74.1.1 Function

This primitive is used by an AP to initiate a Group Membership Request to a specified associated STA.

##### 10.3.aa74.1.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME- MLME-GROUP-MEMBERSHIP.request(

 Peer MAC Address

 DialogToken

 )

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| Peer MAC Address  | MACAddress | Any valid individual MACAddress | The address of the peer MAC entity to which the Group Membership Request is to be sent. |
| DialogToken  | Integer | 0–255 | Specifies a number unique to the MLME-GROUP-MEMBERSHIP.request primitive  |

##### 10.3.aa74.1.3 When Generated

The primitive is generated by the SME at an AP to request the sending of a Group Membership Request to the associated STA indicated by Peer MAC Address.

##### 10.3.aa74.1.4 Effect of Receipt

On receipt of this primitive, the MLME constructs a Group Membership Request frame. The AP then attempts to transmit this frame to the STA indicated by Peer MAC Address.

#### 10.3.aa74.2 MLME-GROUP-MEMBERSHIP.confirm

##### 10.3.aa74.2.1 Function

This primitive reports the result of a request for a STA’s group membership.

##### 10.3.aa74.2.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-GROUP-MEMBERSHIP.confirm(

 Result Code,

Group Address

 )

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| Result Code  | Enumeration  | SUCCESS, INVALID PARAMETERS or UNSPECIFIED FAILURE | Reports the outcome of a group membership request |
| Group Address | MAC Address | Any valid MAC address that has the Individual/Group address bit set | Zero or more MAC addresses that correspond to the contents of the dot11GroupAddressTable of the STA that responded to the group address request. |

##### 10.3.aa74.2.3 When Generated

This primitive is generated by the MLME as a result of an MLME-GROUP-MEMBERSHIP.request primitive indicating the results of that request.

This primitive is generated when that MLME-GROUP-MEMBERSHIP.request primitive is found to contain invalid parameters, or when the STA receives a response in the form of a Group Membership Response frame in the corresponding Robust Action frame from the associated STA.

##### 10.3.aa74.2.4 Effect of Receipt

The SME is notified of the results of the group membership request procedure.

The SME should operate according to the procedures defined in 11.22.15.aa2.

#### 10.3.aa74.3 MLME-GROUP-MEMBERSHIP .indication

##### 10.3.aa74.3.1 Function

This primitive indicates that a Group Membership Request has been received from a peer entity.

##### 10.3.aa74.3.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-GROUP-MEMBERSHIP.indication(

 Peer MAC Address

 DialogToken

 )

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| Peer MAC Address  | MACAddress | Any valid individual MACAddress | The address of the peer MAC entity from which the Group Membership Request was sent. |
| DialogToken  | Integer | 0–255 | Specifies a number unique to the MLME-GROUP-MEMBERSHIP primitive  |

##### 10.3.aa74.3.3 When Generated

This primitive is generated by the MLME when a valid Group Membership Request frame is received.

##### 10.3.aa74.3.4 Effect of Receipt

On receipt of this primitive, the SME performs the behavior defined in 11.22.15.aa2.2

#### 10.3.aa74.4 MLME-GROUP-MEMBERSHIP .response

##### 10.3.aa74.4.1 Function

This primitive responds to the request for the contents of the group address table by a specified STA’s MAC entity.

##### 10.3.aa74.3.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-GROUP-MEMBERSHIP.response(

 Peer MAC Address

 DialogToken,

Group Address

 )

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| Peer MAC Address  | MACAddress | Any valid individual MACAddress | The address of the peer MAC entity to which the Group Membership Response will be sent. |
| DialogToken  | Integer | 0–255 | Specifies a number unique to the MLME-GROUP-MEMBERSHIP primitive  |
| Group Address | MAC Address | Any valid MAC address that has the Individual/Group address bit set | Zero or more MAC addresses that correspond to the contents of the dot11GroupAddressTable of the STA that is responding to the group address request. |

##### 10.3.aa74.3.3 When Generated

This primitive is generated by the MLME as a result of an MLME-GROUP-MEMBERSHIP.indication primitive.

##### 10.3.aa74.3.4 Effect of Receipt

On receipt of this primitive, the SME performs the behavior defined in 11.22.15.aa2.2

# 11.MLME

## 11.2 Power management

### 11.2.1 Power management in an infrastructure network

Change the fourth paragraph of 11.2.1 as follows:

EDITORIAL NOTE: The fourth paragraph of P802.11-2007 has been split in two in REVmb as paragraphs 3 and 6. The following is the third paragraph in clause 10.2.1 in REVmb D6.0

If any STA in its BSS is in PS mode, the AP shall buffer all non-GCR-SP group addressed BUs and deliver them to all STAs immediately following the next Beacon frame containing a DTIM transmission. This is known as Active-PS Delivery method.

EDITORIAL NOTE: The fourth paragraph of P802.11-2007 has been split in two in REVmb as paragraphs 3 and 6. The following is the sixth paragraph in clause 10.2.1 in REVmb D6.0

In a BSS operating under the DCF, or during the CP of a BSS using the PCF, upon determining that a BU 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 BU immediately, or acknowledge the PS-Poll and respond with the corresponding BU at a later time. If the TIM indicating the buffered BU 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 BU is received (or the CFP ends).

#### 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 buffered for that STA. The AP shall transmit buffered individually addressed BUs to a PS STA only in response to a PS-Poll from that STA, during the CFP in the case of a CFPollable PS STA, during a scheduled or unscheduled APSD service period for the STA, or during the SP of a scheduled GCR-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 GCR-SP, to transmit, and to await responses to transmitted PS-Poll frames or (for CF-Pollable STAs) to receive CF transmissions of buffered BUs. |

#### 11.2.1.2 AP TIM transmissions

Change 11.2.1.2 as follows:

EDITORIAL NOTE: This is clause 10.2.1.3 in REVmb D6.0

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-GCR-SP group addressed BUs. The AP shall identify those STAs for which it is prepared to deliver buffered BUs 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:

EDITORIAL NOTE: This is clause 10.2.1.4 in REVmb D6.0

Two different TIM types are distinguished: TIM and DTIM. After a DTIM, the AP shall transmit buffered non-GCR-SP group addressed BUs 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 BU for the receiving STA. The receiving STA then generates a PS-Poll frame, which elicits the transmission of the buffered BU from the AP. Non-GCR-SP Ggroup addressed BUs 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

EDITORIAL NOTE: This is clause 10.2.1.5 in REVmb D6.0

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 STA, which is a QoS data or QoS Null frame using 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 a delivery-enabled AC and destined for the non-AP STA, 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, 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.

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, for example with the Active GCR-SP delivery method, the scheduled SP starts from the Service Start Time without a fixed delivery interval. 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. When the access policy is contention-based channel access for a GCR group addressed stream, a scheduled SP is set-up according to 11.22.15.aa2.3. 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, theA non-AP STA using scheduled SP shall first wake up at the service start time to receive a) downlink unicast individually addressed and/or GCR-SP group addressed frames buffered and/or b) polls from the AP/HC.

If the SI is non-zero, tThe STA shall wake up subsequently at a fixed time interval equal to the SI. The AP may modify the non-GCR service start time by indicating so in the Schedule element in ADDTS Response frame and in Schedule frames. The AP may modify the GCR service start time by indicating so in the Schedule element in the GCR Response elements (see11.22.15.aa2.4(#1046)). In both non-GCR and GCR cases, the service start time shall be updated (using the previously described service start time modification procedures) whenever the upper 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 GCR Request. If the SI is non-zero, tThe STA shall wake up at a subsequent time when

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

If the SI is non-zero, a scheduled SP for a GCR group ends after the AP has attempted to transmit at least one BU associated with the GCR 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 GCR SP shall have the EOSP field set to 1.

If a scheduled Service Period overlaps the time during which the AP is required to transmit non-GCR-SP group address frames and frames individually addressed to non-AP STAs in PS mode that follow a DTIM beacon that has at least one bit set to one in the Partial Virtual Bitmap of its TIM(#1106), the scheduled SP is deferred until the AP has transmitted all such buffered frames.

The scheduled Service Interval field equals 0 when using the Active GCR-SP delivery method. If a non-AP STA has a GCR agreement with an AP for a group address using the Active GCR-SP delivery method, there is no defined end of the scheduled SP(#1105) and(#1107) the non-AP STA shall enter the Awake state and shall remain awake in order to receive the buffered group addressed BUs until the AP changes the delivery method of the stream to other than Active GCR-SP, or the GCR agreement is canceled.

If non-GCR 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 GCR-SP delivery method may be used on any AC, irrespective of the non-GCR 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-GCR-SP frames of the same AC at the same time.

APSD shall be used only to deliver individually addressed BUs and GCR-SP BUs to a STA. Non-GCR and non-GCR-SP gGroup addressed BU delivery shall follow the frame delivery rules defined for group addressed BUs 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 IEEE P802.11v D16.0.

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-GCR-SP group addressedbroadcast or multicast traffic is buffered, according to 7.3.2.6.
2. All broadcast/multicastnon-GCR-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-GCR-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-GCR-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-GCR-SP group addressed MSDUs. If the AP is unable to transmit all of the buffered non-GCR-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-GCR-SP group addresses there are still buffered frames, until all buffered non-GCR-SP group addressed frames have been transmitted.

When the AP transmits an STBC DTIM or TIM Beacon frame, the AP shall retransmit all non-GCR-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-GCR-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 IEEE P802.11v D16.0.

1. All non-GCR-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-GCR-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-GCR-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-GCR-SP group addressed MSDUs. If the AP is unable to transmit all of the buffered non-GCR-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-GCR-SP group addresses there are still buffered frames, until all buffered non-GCR-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-GCR-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-GCR-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-GCR-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.

## 11.22 Wireless network management procedures

Change the title of 11.22.15 as follows

### 11.22.15 Directed Multicast Service and Groupcast with Retries DMS Procedure

Insert the subclause title of 11.22.15.1 after the title of 11.22.15 as follows

#### 11.22.15.1 DMS Procedures

EDITORIAL NOTE—the following change is based on IEEE P802.11v D16.0.

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 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.aa2 GCR Procedures

##### 11.22.15.aa2.1 Overview

A STA that implements the procedures defined in 11.22.15.aa2.2, 11.22.15.aa2.3, 11.22.15.aa2.4, 11.22.15.aa2.5 and 11.22.15.aa2.6 has the MIB attribute dot11GCRImplemented set to true(#1314). When dot11GCRImplemented is true, dot11MgmtOptionDMSImplemented and dot11HighThroughputOptionImplemented shall be true. A STA that implements advanced GCR supports GCR-Block-Ack (11.22.15.aa2.7) and GCR-SP (11.22.15.aa2.8), and has the MIB attribute dot11AdvancedGCRImplemented set to true. When dot11AdvancedGCRImplemented is true, dot11GCRImplemented shall be true.(#1012)

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

1. A GCR 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 GCR includes several retransmission policies and delivery methods.

DMS allows the transmission of group addressed MSDUs as individually addressed A-MSDUs and is particularly suited to low numbers of group members. It provides a high level of reliability but has low scalability as the efficiency decreases and delay increases proportionally to the number of group members.

GCR employs the DMS Request and DMS Response elements with the addition of GCR Request and Response subelements respectively for administering the set up and tear down of GCR services between an AP and non-AP STAs. The DMS procedures and state machine of 11.22.15.1 shall apply to GCR with the extensions and constraints specific to GCR described below in 11.22.15.aa2.3 to 11.22.15.aa2.8.

GCR defines two additional retransmission policies for group addressed frames, in addition to the mechanisms defined in 9.2.7 (labeled “No-Ack/No-Retry” or “non-GCR”), and 11.22.15.1 (labeled DMS):

* GCR-Unsolicited-Retry
* GCR-Block-Ack

When using the GCR-Unsolicited-Retry delivery method for a group address, the AP retransmits an MSDU one or more times (subject to applicable MSDU lifetime limts)(#1240) to increase the probability of correct reception at STAs that are listening to this group address. The decision to retransmit these MSDUs is implementation dependant. GCR-Unsolicited-Retry is particularly suited to use with large numbers of group members as it has moderate delay, efficiency and reliability, but high scalability.

The GCR-Block-Ack delivery method extends the block acknowledgement mechanism to group addressed frames. The AP initiates block Ack agreements with each associated STA that supports GCR-Block-Ack for a particular group address. Once this block Ack agreement is in place, the AP regularly sends Block Ack Request frames to these STAs to ascertain the reception status of MSDUs related to this group address, as described in 9.10.aa10. This allows the AP to discover MSDUs that have failed to be received and to schedule their retransmission. GCR-Block-Ack is particularly suited to use with moderate numbers of group members as it has moderate delay, high efficiency, moderate scalability and reliability.

The GCR service has two delivery methods for group addressed frames:

* As per 11.2.1 (labeled “Active-PS”) or FMS (see 11.2.1.4a) (collectively labeled “non-GCR-SP”)
* GCR-SP (see 11.22.15.aa2.8)

GCR-SP transmits GCR group addressed frames at regular intervals. Compared to non-GCR-SP, GCR-SP has lower delay and jitter and moderate power savings.

##### 11.22.15.aa2.2 GCR Group Membership Procedures

The procedures described in clauses 11.22.15.aa2.3 to 11.22.15.aa2.8 depend upon the AP knowing the membership of the multicast groups of its associated STAs that support GCR.

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.aa13.3) to request the contents of the dot11GroupAddressesTable of its associated STAs.

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 RFC 3376 (Internet Group Management Protocol (IGMP)) snooping.

An associated STA for which dot11GCRActivated 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 dot11GCRActivated is true shall set dot11GCRGroupMembershipAnnouncementActivated to true upon reception of a Group Membership Request frame from the AP with which it is associated.

An associated STA for which both dot11GCRActivated and dot11GCRGroupMembershipAnnouncementActivated are true shall send an unsolicited 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, every time the contents of the dot11GroupAddressesTable is modified.

##### 11.22.15.aa2.3 GCR Setup Procedures

If an AP for which dot11GCRActivated is true detects that an associated STA with Robust AV Streaming set to 1 in the Extended Capabilities element in the STA’s most recent (Re)Association Request is receiving one or more group addresses for which there is an active GCR service and it does not have a GCR agreement for the group(s), then the AP may alert the associated STA by sending an unsolicited individually addressed DMS Response frame that contains one DMS Status field with a GCR Response subelement per group address. Each DMS Status field includes a TCLAS element to identify the GCR group address, the DMSID corresponding to this GCR traffic flow, and other associated parameters. The Status field of this DMS Status field shall be set to “GCR Advertise”. The associated STA may ignore the DMS Response frame, or initiate a GCR agreement for one or more of the group addresses.

A non-AP STA may request use of the GCR service for a group address by sending a DMS Descriptor as described in 11.22.15.1 with the following modifications:

* The DMS Descriptor shall contain one TCLAS element with Frame classifier type equal to 0 (Ethernet parameters), one TSPEC element and one GCR 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).
* 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.
* The TSID subfield within the TS Info field of the TSPEC element shall be reserved. Since the AP might choose a delivery method of GCR-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.
* The GCR Request subelement specifies the retransmission policy and delivery method requested by the non-AP STA for the group addressed stream. (#1049)

A non-AP STA shall not request transmission of a (#1320)group address via the GCR service 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 while it has an active GCR service for this group address.

An AP accepts a GCR request by sending a DMS Status field with the Status field set to “Accept” as described in 11.22.15.1 with the following modifications:

* The DMS Status field shall include a GCR Response subelement indicating the retransmission policy and delivery method and GCR Concealment Address for the group addressed stream. The Retransmission Policy field shall not be set to “No Preference”. The Delivery Method field shall not be set to “No Preference”.(#1081) The GCR Concealment Address field of the GCR Response subelement shall be set to dot11GCRConcealmentAddress.
* If the GCR group address stream is subject to the GCR-SP delivery method, 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 GCR Request subelement, the AP may adopt the requested retransmission policy and delivery method, maintain its existing retransmission policy and delivery method, select an alternate retransmission policy and delivery method or deny GCR service for the group addressed stream.

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

An AP denies a GCR request by sending a DMS Status field with the Status field set to “Deny” as described in 11.22.15.1 with the following modification(#1082):

* The DMS Status field shall include an empty GCR Response subelement

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

If the non-AP STA determines that one or more GCR Response subelements are unacceptable, then the non-AP STA shall discard any received ADDBA request frames for the unacceptable GCR 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 GCR stream. The DMSID fields shall be set to the DMSIDs of the unacceptable streams and the Request Type field shall be set to “Remove”.

If the non-AP STA accepts the GCR Response, it shall set dot11GCRConcealmentAddress to the value contained in the GCR Concealment Address field of the GCR Response subelement.

For each group addressed stream requested by the non-AP STA, the AP shall immediately initiate a Block Ack negotiation if all of(#1241) the following conditions are true:

* The AP advertised an Advanced GCR field set to 1 in its Extended Capabilities element
* The non-AP STA advertised an Advanced GCR field set to 1 in the Extended Capabilities element in the (Re)Association(#1013) Request most recently received by the AP.

If all the above conditions are true the AP shall immediately initiate a Block Ack negotiation by sending an ADDBA Request frame to the non-AP STA that originated the GCR 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). The A-MSDU Supported subfield within the ADDBA frames shall be set to 1 (A-MSDU permitted). Non-AP STAs shall maintain this Block Agreement for the duration of their GCR agreement, irrespective of whether the GCR-Block-Ack is the current retransmission policy or not. While the retransmission policy of the GCR group address stream is DMS, 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 a GCR group address allows the AP to change the GCR retransmission policy dynamically irrespective of the current GCR retransmission policy.

A GCR 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:

* The DMS Status field shall include a GCR Response subelement

##### 11.22.15.aa2.4 GCR Frame Exchange Procedures

A GCR-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 GCR-Block-Ack agreement expires (see 9.10.5), or the GCR agreement no longer exists.

An AP may transmit a group address stream via the No-Ack/No-Retry (non-GCR; see 9.2.7) service and GCR service simultaneously. The AP shall transmit each frame via the No-Ack/No-Retry retransmission policy before it transmits the frame via the GCR service, except when using the GCR-SP delivey method. The AP may transmit each frame via the No-Ack/No-Retry retransmission policy before or after it transmits the frame via the GCR service when using the GCR-SP delivery method.(#1050) An AP may switch dynamically between the DMS(#1199), GCR-Block-Ack or GCR-Unsolicited-Retry delivery modes, but only one delivery mode may be active at any given time for each GCR group address.

An AP shall transmit a frame belonging to a group address via the GCR service if any(#1243) associated STA has a GCR agreement for the group address, and otherwise does not transmit the frame via the GCR service.

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

* The group address is the broadcast address, or (#1244)
* The group address is not the broadcast address and at least one associated STA has the Robust AV Streaming bit set to 0 in the Extended Capabilities element of the STA’s most recent (Re)Association Request and(#1015) 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), or
* The group address is not the broadcast address and at least one non-AP STA has a Block-Ack agreement for the group address and the frame precedes the start of the Block Ack agreement (the sequence number of the frame is less than the starting sequence number of the block Ack agreement, as described in 9.10.2).(#1242)

To avoid undetected retries being passed up at a receiver’s MAC-SAP, duplicate detection and removal for group addressed frames is required in STAs with dot11RobustAVStreamingImplemented set to true (see 9.2.9). A non-SP STA that has an active GCR agreement shall discard all MPDU and A-MPDU which have the Address 1 field set to the group address of this GCR group.(#1097)

NOTE⎯While a GCR agreement is active, the STA will receive MSDUs for this group either via the STAs unicast MAC address (DMS delivery method) or the GCR concealment address (GCR-Block-Ack or GCR-Unsolicited-Retry delivery method)(#1097)

GCR 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 for the group addressed stream is GCR-SP, then the non-AP STA ensures it is awake for subsequent SPs (see 11.22.15.aa2.8).

A non-AP STA may request a change of GCR 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 11.22.15.1 with the following modifications:

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

The AP may update the retransmission policy, delivery method, and schedule as the size of the group changes, the capabilities of the members of the group change, GCR 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 either(#1200):

* (#1016)
* Transmitting an unsolicited DMS Response frame with the current settings addressed to the GCR concealment(#1017) 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 GCR Subselement shall be included per DMS Descriptor in the DMS Response element of the DMS Response frame to identify each GCR stream. The DMSID that identifies the GCR stream shall be included the DMS Descriptor. Each Status field in the DMS Status fields included in the frame shall be set to GCR Advertise.
* Transmitting unsolicited DMS Response frames with the current settings individually addressed to each GCR group member. The DMSID shall be included in per DMS Descriptor in the DMS Response element of the DMS Response frame to identify each GCR stream. No TCLAS element, no TSPEC element and no GCR Subselement shall be included in these DMS Descriptors. Each Status field in the DMS Status fields included in the frame shall be set to GCR Advertise.

Non-AP STAs shall recover from missing group addressed GCR Response frames that advertise a changed retransmission policy or delivery method according to Table 11-aa1 or Table 11-aa2, respectively.

|  |
| --- |
| Table 11-aa1: Non-AP STA recovery procedures for a changed retransmission policy |
| Current retransmission policy state at non-AP STA | Actual retransmission policy being used by the AP | Recovery procedure |
| GCR-Unsolicited-Retry or GCR-Block-Ack | No-Ack/No-Retry | A non-AP STA cancels the GCR service for the group address when no frames for the group address are received via the GCR service after a period of dot11GCRPolicyChangeTimeout  |
| DMS | GCR-Unsolicited-Retry or GCR-Block-Ack | A non-AP STA shall update its current retransmission policy of the GCR stream to GCR-Unsolicited-Retry upon receiving an A-MSDU(#1018) for the DMS group address concealed via the GCR Concealment address.  |
| GCR-Unsolicited-Retry or GCR-Block-Ack | DMS | A non-AP STA shall update its current retransmission policy of the GCR stream to DMS upon receiving an A-MSDU with the RA field set to the non-AP STA’s individual address and the DA field of the A-MSDU subframe set to the GCR group address. |
| GCR-Unsolicited-Retry | GCR-Block-Ack | A non-AP STA shall update its current retransmission policy of the GCR stream to GCR-Block-Ack upon receiving a BlockAckReq frame with a GCR Group Address subfield set to the GCR group address |
| GCR-Block-Ack | GCR-Unsolicited-Retry | A non-AP STA shall update its current retransmission policy of the GCR stream to GCR-Unsolicited-Retry if MSDUs for the GCR group address concealed via the GCR Concealment address are being received yet no BlockAckReq frames for the GCR group address are received when the block ack agreement timeout occurs. |

|  |
| --- |
| Table 11-aa2: Non-AP STA recovery procedures for a changed delivery method |
| Current delivery method state at non-AP STA | Actual delivery method being used by the AP | Recovery procedure |
| Non-GCR-SP | GCR-SP | A non-AP STA shall update the current delivery method state of the GCR stream to GCR-SP if1. no frames with the More Data field in the Frame Control field(#1157) set to 1 for the GCR stream are received for a period of dot11GCRPolicyChangeTimeout, and
2. at least one frame for the GCR stream with the More Data(#1157) field in the Frame Control field set to 0 is received.

Note that upon detecting condition a), the STA should enter the Awake state in order to assist with detecting condition b). |
| GCR-SP | Non-GCR-SP | A non-AP STA shall update the current delivery method of the GCR stream to Non-GCR-SP if 1. no frames with the More Data(#1157) field in the Frame Control field set to 0 for the GCR stream are received for a period of dot11GCRPolicyChangeTimeout, and
2. at least one frame for the GCR stream with the More Data(#1157) field in the Frame Control field set to 1 is received.
 |

A GCR agreement between a non-AP STA and an AP shall end as described in 11.22.15.1 when:

* The AP deauthenticates or disassociates the non-AP STA, or(#1201)
* The non-AP STA successfully transmits a DMS Request frame to the AP containing a DMS Request element that has a DMS Descriptor with the DMSID identifying the group addressed stream and the Request Type field set to “Remove”, or
* The AP successfully transmits an individually addressed DMS Response frame with a DMS Response element containing a DMS Status field with the DMSID identifying the group addressed stream that has the Status field set to “Terminate”

A GCR agreement between a non-AP STA and an AP shall end as described in 11.22.15.1 with the following modifications:

* The DMS Status field shall include a GCR Response subelement
* The DMS response frame may instead by transmitted to the broadcast or GCR group addresses

A cancellation of a GCR agreement shall also cause the Block Ack agreement to be cancelled for the GCR stream.

##### 11.22.15.aa2.5 Concealment of GCR transmissions

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

GCR group addressed MSDUs transmitted via the GCR-Unsolicited-Retry or GCR-Block-Ack retransmission policies shall be sent in an A-MSDU frame format with the RA set to the GCR Concealment address dot11GCRConcealmentAddress. The DA field in the A-MSDU subframe shall contain the group address of the GCR group address that is being concealed (i.e. the same value as the DA field for non-GCR group addressed delivery). Multiple A-MSDU subframes may be contained within one A-MSDU frame, subject to the A-MSDU and MPDU size limitations, as described in 7.2.2.2 and 7.4a.(#1150)

A STA with dot11RobustAVStreamingImplemented set to true shall not use the GCR Concealment address for any purpose other than the transmission of GCR streams.

A STA with dot11RobustAVStreamingImplemented set to true and at least one GCR agreement shall add the GCR Concealment address to the STA’s dot11GroupAddressesTable.

The Individual/Group (I/G) address bit (LSB of octet 0) and the Universally or Locally administered (U/L) bit (the bit of octet 0 adjacent to the I/G address bit.) of dot11GCRConcealmentAddress shall both be set.

##### 11.22.15.aa2.6 GCR-Unsolicited-Retry

A STA supports the GCR-Unsolicited-Retry retransmission policy if dot11RobustAVStreamingImplemented is true; otherwise the STA does not support the GCR service with retransmission policy equal to GCR-Unsolicited-Retry.

An AP adopting the GCR-Unsolicited Retry retransmission policy for a GCR 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 GCR group addresses. An AP adopting the GCR-Unsolicited-Retry retransmission policy for a GCR group address shall transmit each MSDU according to 11.22.15.aa2.5, subject to the lifetime limit. Transmission uses the backoff procedure described in 9.9.1.6.aa1.

If a Block Ack agreement has successfully been established for a group addressed stream that is delivered using the GCR-Unsolicited-Retry retransmission policy, the STA shall follow the duplicate detection procedures defined in 9.2.9 and 9.10.4.

(#1051)If a Block Ack agreement has successfully been established for all STAs receiving a GCR group address *g*, for a group delivered using the GCR-Unsolicited-Retry retransmission policy, the AP may retransmit any of the last *m* A-MSDUs that have the DA field in the A-MSDU subfield set to *g*, where *m* is GCR Buffer Size (as defined in 11.22.15.aa2.7), subject to the lifetime limits.

If there is a STA with an active GCR agreement for a group address *g* that does not have an active Block Ack agreement, the AP shall not retransmit a preceding A-MSDU for that group address. A preceding A-MDSU is defined as an A-MSDU with a sequence number value that precedes the sequence number value of the last transmitted A-MSDU for the GCR group address *g*.

##### 11.22.15.aa2.7 GCR-Block-Ack

A STA supports the GCR-Block-Ack retransmission policy if both dot11RobustAVStreamingImplemented and dot11GCRImplemented are true; otherwise the STA does not support the GCR service with retransmission policy equal to GCR-Block-Ack.

GCR 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 GCR group (see 9.10.aa10).

##### 11.22.15.aa2.8 GCR-SP

The GCR-SP delivery method transmits GCR group addressed frames at regular intervals that might be less than the beacon interval.

A STA supports the GCR-SP delivery method if dot11AdvancedGCRImplemented(#1019) is true; otherwise the STA does not support the GCR service with Delivery method equal to GCR-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 GCR-SP for group address traffic that consumes appreciable medium time.

Group addressed MSDUs shall not be transmitted via the GCR-SP delivery method policy if either the Active-PS or FMS delivery methods are active for that group address.

An AP advertises that a group address stream is subject to GCR-SP within a GCR Response subelement. The subelement indicates the start of each Service Period. See 11.2.1.4. At every scheduled SP, the AP schedules for transmission buffered GCR-SP group addressed frames assigned to that particular group address.

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

An AP may use the GCR-SP delivery method for an accepted GCR service when the non-AP STA that requested the GCR service has the Robust AV Streaming bit in the Extended Capabilities element set to 1 and the Advanced GCR bit in the Extended Capabilities element set to 1, otherwise the AP shall not use the GCR-SP delivery method for the acceptec GCR service.(#1322)

When the Service Interval field in the Schedule element of the DMS Response frame is 0, the AP may transmit group addressed frames that are subject to this GCR agreement at any time without regard to the power state of non-AP STAs in the group. This is called Active GCR-SP, where all members of the group need to stay in Active mode to receive these group addressed frames.(#1028)

# Annex A

 (normative)

Protocol Implementation Conformance Statement (PICS) proforma

## A.2 Abbreviations and special symbols

### A.2.2 General abbreviations for Item and Support columns

Insert one new list item at the end of A.2.2 as indicated below:

AVT audio video transport

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

### A.4.3 IUT configuration

Insert this entry to the end of the IUT configuration table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | IUT configuration | References | Status | Support |
| \*CFaa | Is RobustAVT supported? | 5.2.aa12 | (CF12):O | Yes, No, N/A |

Insert this new clause at the end of A.4:

### A.4.aa1 RobustAVT extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Protocol Capability | References | Status | Support |
| AVT1 | Extended Capabilities information element | 7.3.2.27 | CFaa:M | Yes, No, N/A |
| AVT2   AVT2.1 | Groupcast with Retries (GCR)Advanced GCR | 11.22.15.aa2.2, 11.22.15.aa2.3, 11.22.15.aa2.4, 11.22.15.aa2.5, 11.22.15.aa2.67.3.2.27, 11.22.15.aa2.7, 11.22.15.aa2.8, 9.10.aa10 | (CF16 and CFaa): M(#1323)(CFaa and QB5): O | Yes, No, N/AYes, No, N/A |
| AVT3 | Alternate EDCA transmit queues | 9.1.3.1 | CFaa:O | Yes, No, N/A |
| AVT4 AVT4.1 AVT4.2 AVT4.3 | Stream Classification ServiceSCS Request frameSCS Response frameDEI | 11.aa23.27.4.aa13.17.4.aa13.211.aa23.2 | CFaa:OAVT4:MAVT4:M(CF16 and AVT4):M | Yes, No, N/AYes, No, N/AYes, No, N/AYes, No, N/A |
| ATV5 | OBSS Management | 11.aa247.3.2.27 | (CF12):M | Yes, No, N/A |
| ATV6 AVT6.1 AVT6.2 AVT6.3 | QLoad ReportQLoad Report elementQLoad Request frameQLoad Report frame | 11.aa247.3.2.aa937.4.7.aa187.4.7.aa19 | (AVT5 and CF1):MAVT6:MAVT6:MAVT6:M | Yes, No, N/AYes, No, N/AYes, No, N/AYes, No, N/A |
| AVT7 AVT7.1 | HCCA TXOP Advertisement elementHCCA TXOP Negotiation | 7.3.2.aa9411.aa24.3 | (AVT5:M and QP1):MAVT7:O | Yes, No, N/AYes, No, N/A |

# Annex D

(normative)

ASN.1 encoding of the MAC and PHY MIB

dot11GCRImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

“This is a capability variable.

Its value is determined by device capabilities.

This attribute, when TRUE, indicates that the station

implementation supports the GCR features”(#1012)

DEFVAL { false }

::= { dot11StationConfigEntry aa2 }

dot11GCRActivated OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

“This is a control variable.

It is written by the SME or external management entity.

Changes take effect for the next MLME-START.request primitive

or MLME-JOIN.request primitive

This attribute, when TRUE, indicates that the station

implementation supports the GCR procedures as defined in 11.22.15.aa2 and that this has been activated.”

DEFVAL { false }

::= { dot11StationConfigEntry aa21 }

dot11AdvancedGCRImplemented OBJECT-TYPE(#1012)

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

“This is a capability variable.

Its value is determined by device capabilities.

This attribute, when TRUE, indicates that the station

implementation supports the Advanced GCR features”

DEFVAL { false }

::= { dot11StationConfigEntry aa2 }

dot11AdvancedGCRActivated OBJECT-TYPE(#1012)

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

“This is a control variable.

It is written by the SME or external management entity.

Changes take effect for the next MLME-START.request primitive

or MLME-JOIN.request primitive

This attribute, when TRUE, indicates that the station

implementation supports the GCR procedures as defined in 11.22.15.aa2 and that this has been activated.”

DEFVAL { false }

::= { dot11StationConfigEntry aa21 }

References: