IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frame Type Encoding | | | | |
| Date: 2014-09- | | | | |
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|  |  |  |  |  |

Abstract

This document proposes a resolution of CC17 comments related to EPD versus LPD, mixed GLK/non-GLK BSSes, GLK STA identification and capability indication, and the like, in 802.11ak D0.03.

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# Background

802.11ak (also known as GLK (General Link)) amends 802.11 to support 802.11 transit links within bridged networks.

P802.11ak drafts D0.01 thru D0.03 propose to handle this for GLK associations, which must be usable as transit links in an 802.1Q conformant network, by, among other things, using EPD for all MSDUs sent on such associations, restricting association with a GLK AP to GLK non-AP STAs,

To resolve the comments listed below, this document proposes changes to P802.11ak\_D0.03 to permit support for both EPD and LPD, permit mixed BSSes, and makes changes in the solution to the subsetting problem eliminating CBA-MSDUs, all as outlined in 11-14/977.

# Comment Resolutions

Note that references are to 11ak\_D0.01.

Clause Page Line

## CID 36

|  |  |  |
| --- | --- | --- |
| 6.3.11 | 16 | 38 |

**Comment:** While it seems technically accurate that the CapabilityInformation carries enough information to determine if an MLME-START is for a GLK BSS or not, indicating it only this way is not consistent with other BSS types. Others are also indicated in the BSSType parameter. I think we want to be consistent, even if a bit redundant, perhaps.

**Commenter’s Suggested Remedy:** Remove the Note about MLME-START, and instead modify MLME-START to have a GLK BSS type added to the BSSType parameter enumeration.

**New Response: Revise. GLK is really orthogonal to the existing BSS types so it is best to add a new GLK capabilities parameter to MLME.START.**

## CID 38

|  |  |  |
| --- | --- | --- |
| 8.4.2.3 | 24 | 10 |

**Comment:** If we change the Capability Information to not set ESS or IBSS (see other comment), we don't need to overload the Supported Rates selectors to prevent legacy STA confusion by GLK BSSes.

**Commenter’s Suggested Remedy:** If the other comment is accepted, remove the changes here.

**New Response: Reject. There are already “non-rate” things in the Supported Rates IE which we are re-naming for clarity. And a GLK STA could reasonably want to set ESS or IBSS.**

## CID 49

|  |  |  |
| --- | --- | --- |
| 4.3.21.3 | 7 | 18 |

**Comment:** Since only a group addressed MPDU transmitted by a GLK AP requires Control Block, using CBA-MSDU format every time causes unnecessary overhead. A GLK STA shall be able to use the normal A-MSDU for throughput improvement.  
To distinguish a frame that contains Control Block from other frame, it shall be defined as a new Extension frame 'CB QoS Data'.

**Commenter’s Suggested Remedy:** 1) Replace 4.3.21.3 by follows;  
---  
A GLK AP may use the Control Block (CB) QoS Data frame to specify which members of the group addressed non-AP STAs by the CB QoS Data frame will process MSDU(s).  
Support of the CB QoS Data frame is optional. When the GLK AP does not use the CB QoS Data frame, the GLK AP converts a group addressed MPDU to multiple individually addressed MPDUs.  
  
2) Define a new Extension frame type CB QoS Data in 8.2.4.1.3 by modifying the Table 8-1 as follows;  
----  
11 Extension <ANA> CB QoS Data  
11 Extension <ANA+1>-1111 Reserved  
  
3) Specify a CB QoS Data frame in 8.3.4 and remove 8.3.2.3.  
  
4) Replace "CBA-MSDU" by "CB QoS Data" throughout the draft  
  
A submission 11-14/0539 will provide proposed texts.

N**ew Response: Revise: CBA-MSDU material deleted.**

## CID 59

|  |  |  |
| --- | --- | --- |
| 8.3.2.3 | 19 | 22 |

**Comment:** The current CB mechanism is too complex for efficient implementation. SIPD-CB and Vendor Specific CB are not necessary.

**Commenter’s Suggested Remedy:** 1) Change CBA-MSDU structure (Figure 8-48a) to include only one CB.  
2) Delete SIPD-CB related description.  
3) Delete Vendor Specific CB related description.  
4) Change CB Header structure (Figure 8-48c) as follows;  
 - B0 is CB Type (0 = SE-CB, 1 = SI-CB)  
 - B1 to B5 is reserved  
 - B6 to B15 is CB Data Length

N**ew Response: Revise: CBA-MSDU material deleted.**

## CID 60

|  |  |  |
| --- | --- | --- |
| 9.2.8 |  |  |

**Comment:** It is necessary to specify addressing rules for GLK STA to support following cases required by a GLK STA.  
- A GLK AP transmits an individually addressed MSDU as a group addressed MPDU when a final destination is not learned by associated 802.1Q bridge.  
- A GLK STA transmits a group addressed MSDU as an individually addressed MPDU when CB QoS Data frame is not used.

**Commenter’s Suggested Remedy:** 1) Insert the following text after the fifth paragraph of 9.2.8 (P1241L23 of 802.11mc D2.7).  
----  
A GLK STA also uses the address matching rules described in 9.42.1 (Addressing of individually addressed data frames for GLK STA), when it receives an individually addressed frame. A GLK STA also uses the address matching rules described in  
9.42.2 (Addressing of group addressed data frames for GLK STA).  
  
2) Insert new subclauses 9.42.1 (Addressing of individually addressed data frames for GLK STA) and 9.42.2 (Addressing of group addressed data frames for GLK STA), and specify the addressing rule of a MPDU for a GLK STA. A submission 11-14/0539 will provide proposed texts.

N**ew Response:**

## CID 62

|  |  |  |
| --- | --- | --- |
| 10.24.16 |  |  |

**Comment:** A wireless link is less reliable than a wired link, and there is no MAC-level recovery on group addressed transmission except DMS and GCR (as described in the paragraph of IEEE P802.11mc D2.7 subclause 9.3.6). A GLK STA should support DMS and optionally support GCR for enhanced reliability.  
Since current DMS/GCR mechanism does not support selective reception of a group addressed MPDU, it is necessary to specify the DMS/GCR procedure for a GLK STA.

**Commenter’s Suggested Remedy:** Modify the GCR related description in 9 and 10.24.16 to support a MPDU with Control Block.  
A submission 11-14/0539 will provide proposed texts.

N**ew Response:**

## CID 63

|  |  |  |
| --- | --- | --- |
| 4.3.21.1 | 6 | 28 |

**Comment:** [for David Kloper] We are asserting that GLK is the role of the STA. I would recommend that this be the role in an association between 2 STA, so a device can both service Clients as an AP and provide bridging / backhaul as GLK over the same physical radio.

**Commenter’s Suggested Remedy:** We should reword this section to leave open the role being per association. To that end we should have 2 bits, so that Beacons/Probes can indicate both capable of accepting a GLK as well as requiring GLK only. Then Assoc/re-assoc can indicate role being requested.

N**ew Response:**

## CID 64

|  |  |  |
| --- | --- | --- |
| 4.3.21.1 | 6 | 28 |

**Comment:** [for David Kloper] I don't think we should be adding capability bits to existing Info Elements vs creating a new GLK IE. This will allow negotiation of other GLK related options.

**Commenter’s Suggested Remedy:** Replace reference to those 2 IE, and add a reference to a new IE section we should create.

N**ew Response:**

## CID 65

|  |  |  |
| --- | --- | --- |
| 4.3.21.1 | 7 | 4 |

**Comment:** [for David Kloper] The use of 4 address, as written looks optional and should be mandated. That is the purpose it was intended for, most specifically for unicast traffic.

**Commenter’s Suggested Remedy:** "GLK STAs support the 4-address format (see 8.2.3)" -> "Data frames between GLK STAs must use the 4-address format (see 8.2.3)"

N**ew Response:**

## CID 66

|  |  |  |
| --- | --- | --- |
| 4.3.21.2 | 7 | 6 |

**Comment:** [for David Kloper] I agree that the encoding for VLAN tags, as currently in the 802.11 standard is broken and should be fixed. However, switching to LPD may interfere with HW acceleration some vendors may be including in 11ac chips, and hinders the ability for sniffers and wIDS subsystems that may not know the roles of the peers. In addition, it fundamentally breaks the A-MSDU format which depends on the Len field in order to be parsed on Ingress. This LPD choice may be an historical poor choice, but we should limit ourselves to fixing what is broken vs crusading for purity.

**Commenter’s Suggested Remedy:** I recommend that we just convert the outer EtherType to SNAP w/o looking toward subsequent tags when translating between LPD and EPD. This fixes the concerns, of the current encoding with minimal impact.

N**ew Response:**

## CID 68

|  |  |  |
| --- | --- | --- |
|  | 1 |  |

**Comment:** [for David Kloper] I think the use of Mcast (RA not DA), and the complexity you have added w/ CBA-MSDU is not worthwhile. With 10% PER + collisions + selection of lower data rates for Mcast, this may be unavoidable on the last hop to Clients, but on intermediate GLK links it will quickly add up over multiple hops, and make the network unusable. Better to layer Bridging on a reliable / low PER link, after unicast MAC layer retries.

**Commenter’s Suggested Remedy:** Recommend that: 1) Replication as unicast 4 Addr frames to the desired set of Peers is called out as mandatory; 2) If keeping support for Mcast RA, it is negotiated (support being optional), and only used to the set of supporting peers; 3) Simplification of CBA-MSDU format, which is only used for Mcast RA;

N**ew Response:**

## CID 69

|  |  |  |
| --- | --- | --- |
|  | 1 |  |

**Comment:** [for David Kloper] Concerns: Aggregation is critical to 11n/11ac/11ad performance, and subversion of A-MSDU can severely impact that. I think Egress processing would be an issue, as marking is by aggregate vs MSDU, and frames are entering the bridge function interleaved between interfaces/flows and so can be expected to have different sets of destination peers. Ingress processing can be expensive with a complicated format more applicable to Mgmt traffic, requiring linear walking a variable sized, unordered list. As the packet rates go up, this will be a serious concern. Again, these format changes might break any HW acceleration in chipsets.

**Commenter’s Suggested Remedy:** Recommendations if keeping CBA-MSDU: 1) Support is optional, and only used for Mcast RA, as adding no value for Ucast RA; 2) Replace complicated Mgmt frame like format with a fixed sized bitmap; 3) Rather than use AID that only exists in 1 direction, and thus arbitrarily limiting its usage, use the proposed GLK IE to inform each peer which bit is assigned for them in each direction; 4) Strongly prefer bitmap in 24 LSb of RA;

N**ew Response:**

## CID 78

|  |  |  |
| --- | --- | --- |
|  | 1 |  |

**Comment:** Current scheme with CBA-MSDU is more complexity than the use cases can support.

**Commenter’s Suggested Remedy:** 1) GLK stations use the 4-address format only. Whether that 4-address SDU/PDU is aggregated or not is an orthogonal question, and the current rules are followed.  
2) The Receiver address (in 4-address format) can be the broadcast address, but we would not expect that to be used, much.  
3) If we really, really feel that we need it, we could allow the Receiver Address to be a fixed upper 32 bits, and place the AID of the station to \*not\* receive the frame in the lower 16 bits of the Receiver Address. That would take care of the bulk of the issues raised by me (and others) early in the development of 11ak. It is not clear to me, any longer, that this is required, however.  
4) A GLK station, of course, ignores all 3-address frames.

N**ew Response:**

## CID 80

|  |  |  |
| --- | --- | --- |
| 4.3.21.4 | 7 | 27 |

**Comment:** Without the CBA-MSDU, we don't need a "GLK BSS". The current SS types will suffice.

**Commenter’s Suggested Remedy:** Eliminate the GLK BSS. Allow non-GLK and GLK STAs to be in the same BSS. A GLK non-AP STA (if operating in GLK mode, of course) ignores 3-address frames with multicast or broadcast Receiver addresses. The AP (and Bridge) should have no problem keeping things straight -- the non-GLK STAs connect through the existing DS, typically all to a single port in the bridge, and the GLK STAs connect through the new 11ak interface directly to the bridge. Whether point-to-point links between GLK non-AP STAs and non-GLK non-AP STAs are possible needs to be thought about.

N**ew Response:**

## CID 91

|  |  |  |
| --- | --- | --- |
| 8.2.4.1.4 | 18 | 14 |

**Comment:** The procedure for using four address MAC header with both To and From DS "true" by a GLK STA has to be refered and be described there.

**Commenter’s Suggested Remedy:** As in comment.

N**ew Response: Revise - tbd**

## CID 98

|  |  |  |
| --- | --- | --- |
| 8.3.2.3.1 | 21 | 8 |

**Comment:** Move the normative behavior from clause 8 to clause 9.  
Especially, the below sentences are inappropriate to be placed in clause 8.  
"The CB Data length of the SE-CB specifies the length of the list of AIDs. If the CB Data Length is not an even number, a receiving STA shall discard the CBA-MSDU.  
If more than one SE-CB or both an SE-CB and an SI-CB or an SIPD-CB occur in a CBA-MSDU, a receiving STA shall discard the CBA-MSDU."  
"A STA receiving a CBA-MSDU on an association whose AID appears in the SE-CB in that CBA-MSDU shall discard the CBA-MSDU."

**Commenter’s Suggested Remedy:** As per comment.

N**ew Response: Revise – all the CB stuff is going away. Equivalent new stuff will be put in clause 9.**

## CID 99

|  |  |  |
| --- | --- | --- |
| 8.3.2.3.2 | 21 | 24 |

**Comment:** Move the normative behavior from clause 8 to clause 9.  
Especially, the below sentences are inappropriate to be placed in clause 8.  
  
"The CB Data length of the SI-CB specifies the length of the list of AIDs. If the CB Data Length is not an even number, a receiving STA shall discard the CBA-MSDU. If more than one SI-CB or both an SI-CB and an SE-CB or an SIPD-CB occur in a CBA-MSDU, a receiving STA shall discard the CBA-MSDU."  
"An empty AID list, which is indicated by a CB data length of zero, indicates no receiver inclusions so all receiving STAs will discard the CBA-SMDU."

**Commenter’s Suggested Remedy:** As per comment.

N**ew Response: Revise – all the CB stuff is going away. Equivalent new stuff will be put in clause 9.**

# Draft Changes to P802.11ak\_D0.03

# Introduction

***Change text as follows:***

Areas of extension are as follows:

1. Optional support ~~Use~~ of IEEE 802 length/type (EPD), as opposed to ISO/IEC 8802-2 LLC encoding (LPD), in ~~all~~ MSDUs between GLK STAs;
2. Facilities for GLK STAs to send ~~an augmented A-MSDU, called a Control Block A-MSDU (CBA-MSDU), such that~~ group addressed ~~CBA-MSDUs~~ GLK MPDUs that include facilities to send to an arbitrary subset of an AP’s associated GLK STAs;
3. Priority Code Points in 802.1Q have a different default meaning that they do in IEEE Std 802.1D. For example, in 802.1Q, priority 2 is, by default, higher priority than priority 1 while in 802.1D it is lower. Thus GLK STAs use a different UP to AC mapping by default and that mapping may be configured.

# Definitions, acronyms, and abbreviations

## Abbreviations and acronyms

***Change inserted text for Section 3.4:***

~~CB Control Block~~

~~CBA-MDSU Control Block Aggregated MSDU~~

EPD EtherType Protocol Discrimination

GLK General Link

LPD LLC Protocol Discrimination

~~SE-CB Subsetting Exclusion CB~~

~~SI-CB Subsetting Inclusion CB~~

SYNRA Synthetic Receiver Address

# General Description

## Components of the IEEE Std 802.11 architecture

### 4.3.14 STA transmission of Data frames outside the context of a BSS

Editor’s Note: I am told that users of this service are anxious to save every bit they can. Thus it is possible they will want to use SYNMAC abbreviation formatted data frames.

***Change clause 4.3.23 to the following:***

### General Link (GLK)

#### General

***Change the text of clause 4.3.23 as follows:***

GLK STAs establish GLK links with other GLK STAs that are suitable, insofar as the capabilities of IEEE 802.11 permit, to be used as a transit link inside an IEEE Std 802.1Q conformant network. GLK STAs optionally establish non-GLK links with non-GLK STAs the same way that pairs of non-GLK STAs establish links with each other.

A GLK STA provides a set of MAC\_SAPs, one for each GLK link between communicating STAs to an IEEE 802.1Q bridge. A non-AP GLK STA supports the selective reception of a group addressed A-MSDU. A GLK STA uses EtherType Protocol Discrimination (EPD) format MSDUs.

Every link is either a GLK link or a non-GLK link.

All GLK STAs support the 4-address format (see 8.2.3).

#### 4.3.23.2 EtherType Protocol Discrimination (EPD)

***Replace the text of clause 4.3.23.2 with the following:***

LPD is the default format of MSDUs. EPD is only used where it is known that all STAs involved support EPD.

STAs announce, through a Capability Information field bit and a DMG Capability Information field bit, if they support EPD. For pairwise communication between STA in a BSS, EPD is used if both STAs support EPD, otherwise LPD is used.

APs announce, through an entry in the Supported Rates and BSS Membership Selectors IE, if STAs that do not support EPD are permitted to associate. If only STAs supporting EPD may associate, then that AP uses EPD for all MSDUs in MPDUs with a group addressed RA. If STAs not supported EPD may associate, then LPD is used for all such MSDUs.

#### Selective reception of a group addressed MPDUs

***Replace 4.3.23.3 with the following:***

GLK STAs tbd

# MAC service definition

## Overview of MAC services

### MSDU format

***Replace the text of clause 5.1.4 with the following:***

MSDUs use LPD as defined in IEEE Std 802-2014 (Overview and Architecture) for all OCB transmissions and for transmissons within a BSS unless one of the two conditions below, applies.

1. For data MPDUs with individually addressed RAs, if both the transmitter and receiver have indicated EPD support during association or peering.

2. For data MPDUs with group addressed RAs, EPD is used only if the transmitter refuses to associate or peer with and STA not supporting EPD as indicated by the presence of the EPD BSS membership selector in the Supported Rates and BSS Memebership Selector IE advertised by the transmitter.

When LPD is used, in order to achieve interoperability, implementors are recommended to apply the procedures described in ISO/IEC Technical Report 11802-5:1997(E) (previously known as IEEE Std 802.1H-1997 [B21]), along with a selective translation table (STT) that handles a few specific network protocols, with specific attention to the operations required when passing MSDUs to or from LANs or operating system components that use EPD. Note that such translations might be required in a STA.

### MAC data service architecture

#### General

***Modify changes to 5.1.5.1 to be the following:***

During transmission, an MSDU goes through some or all of the following processes: MSDU rate limiting, LPD or EPD encoding, aggregate MSDU (A-MSDU) aggregation ~~including CBA-MSDU construction~~, frame delivery deferral during power save mode, sequence number assignment, fragmentation, encryption, integrity protection, SYNRA construction for group addressed MPDUs to GLK STAs, frame formatting, and aggregate MAC protocol data unit (A-MPDU) aggregation. When transparent FST is used, an MSDU goes through an additional transparent FST entity that contains a demultiplexing process that forwards the MSDU down to the selected TX MSDU Rate Limiting process and thence further MAC data plane processing. IEEE Std 802.1X-2010 may block the MSDU at the Controlled Port. At some point, the Data frames that contain all or part of the MSDU are queued per AC/TS.

During reception, a received Data frame goes through processes of possible A-MPDU deaggregation, MPDU header and cyclic redundancy code (CRC) validation, duplicate removal, discard based on SYNRA, on possible reordering if the block ack mechanism is used, decryption, defragmentation, integrity checking, and replay detection. After replay detection (or defragmentation if security is not used), possible A-MSDU deaggregation ~~including CBA-MSDU processing~~, and possible MSDU rate limiting, one ~~zero~~ or more MSDUs are, delivered to the MAC\_SAP or to the DS. When transparent FST is used, MSDUs originating from different PHY-SAPs go through an additional transparent FST entity that contains a multiplexing process before forwarding the MSDU to the MSDU rate limiting process. The IEEE 802.1X Controlled~~/Uncontrolled~~ Port~~s~~ discards any received MSDU if the Controlled Port is not enabled. The Uncontrolled Port admits the frame for use if it is ~~and if the MSDU does not represent~~ an IEEE Std 802.1X frame and optionally for other protocols that use the Uncontrolled Port. Frame order enforcement provided by the enhanced data cryptographic encapsulation mechanisms occurs after decryption, but prior to MSDU defragmentation; therefore, defragmentation fails if MPDUs arrive out of order.

# Layer management

## MLME SAP interface

### Start

#### Introduction

#### MLME-START.request

##### Function

##### Semantics of the service primitive

***Add a parameter as follows:***

…  
MG Operation,  
Clustering Control,  
CBAP Only,  
PCP Association Ready,  
VHT Capabilities,  
VHT Operation,  
GLK Capabilities,  
VendorSpecificInfo )

***Add a new row as the next-to-last row in the table describing MLME-START.request parameters as follows:***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | GLK Capabilities | As defined in GLK Capabilities element | As defined in 8.4.2.171 (GLK Capabiities element | Specified the parameters in the GLK Capabilities element thart are supported by the STA. Ths parameter is present if dot11GeneralLinkImplemented is true and not present otherwise. |  |
|  |  |  |  |  |  |

***Delete the current Editorial Note claiming that no change is needed in the parameters to MLME-START.request.***

# Frame formats

## General Requirements

## MAC frame formats

### Frame fields

#### Address Fields

#### Duration/ID field

#### Address fields

##### RA field

***Change Clause 8.2.4.3.7 as follows:***

The RA field contains an IEEE MAC individual or group address that identifies the intended immediate recipient STA(s), on the WM, for the information contained in the frame body field. If the intended receipient STA(s) are GLK due to a broadcast, multicast, or unknown unicast destination MAC, the RA shall be a SYNRA as shown in Figure 8a – SYNRA structure.

SYNRA Type

SYNRA OUI + group bit

SYNRA Control field

B0 B23 B24 B25 B26 B47

Bits: 24 2 22

**Figure 8-3a– SYNRA structure**

Values of the SYNRA Type field are listed in Table 8-

tbd

## Formats of individual frame types

### Control Frames

### Data Frames

#### Data frame format

#### Aggregated MSDU (A-MSDU) format

##### General

***Delete the following text at the beginning of Clause 8.3.2.2.1***

There are four variations of the A-MSDU format. If the transmitter is a GLK STA, the CBA-MSDU format or Short CBA-MSDU format is used as specified in 4.3.2.3. If the transmitter is a non-GLK STA, the A-MSDU or Short A-MSDU format is used as described in the remainder of this clause.

***Delete new clause 8.3.2.3:***

### Control Block (CB) A-MSDU (CBA-MSDU) format

### Management frames

#### Format of Management frames

#### Beacon frame format

***Add to Table 8-35 – Beacon frame body as the next to last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | 66 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |
|  |  |  |  |  |

#### Association Request frame format

***Add to Table 8-37 – Association Reqeust frame body as the next to the last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 24 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |

#### Associaton Response frame format

***Add to Table 8-38 – Association Response frame body as the next to the last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 30 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |

#### Reassociation Request frame format

***Add to Table 8-39 – Reassociation Requst frame body as the next to the last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 29 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |

#### Reassociation Response frame format

***Add to Table 8-40 – Reassociation Response frame body as the next to the last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 34 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |

#### Probe Request frame format

***Add to Table 8-41 – Probe Request frame body as the next to last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | 18 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |
|  |  |  |  |  |

#### Probes Response frame format

***Add to Table 8-42 – Probe Response frame body as the third to last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | 68 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |
|  |  |  |  |  |

### Extension frames

#### DMG Beacon

***Add to Table 8-49 – DMG Beascon frame body as the third to last row:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | 15 | GLK Capabilities | The GLK Capabilities element is present if dot11GeneralLinkImplemented is true. |  |
|  |  |  |  |  |

## Management and Extension frame body components

### Fields that are not elements

#### Authentication Algorithm Number field

#### Authentication Transaction Sequence Number field

#### Beacon Interval field

#### Capability Information field

***Change Figure 8-65—Capability Information field (non-DMG STA) and Figure 8-66—Capability Information field (DMG STA) as follows:***

ESS

B0 B1 B2 B3 B4 B5 B6 B7

**Figure 8-65—Capability Information field (non-DMG STA)**

CF Pollable

CF-Poll Request

Short Preamble

Reserved

IBSS

Privacy

Reserved

Spectrum Management

B8 B9 B10 B11 B12 B13 B14 B15

QoS

Radio Measurement

EPD ~~GLK~~

APSD

Delayed Block Ack

Short Slot Time

Immediate Block Ack

DMG Parameters

B0 B7 B8 B9 B11 B12 B13 B14 B15

Reserved

EPD ~~GLK~~

Reserved

Spectrum Management

Radio Measurement

**Figure 8-66—Capability Information field (DMG STA)**

***Update the following in the 2nd to last paragraph of Clause 8.4.1.4:***

A STA sets the ~~GLK~~EPD sub-field in the Capabilities Information field to 1 when dot11~~GeneralLink~~EPDImplemented is true and sets it to 0 otherwise.

### Elements

#### General

***Add the following to Trable 8-62 – Element IDs maintaining order by Element ID number:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | GLK Capabilities (see 8.4.2.171 (GLK Capabilities element)) | <ANA> |  |  |
|  |  |  |  |  |

#### SSID element

***Rename the Supported Rates element:***

#### Supported Rates and BSS Membership Selector element

TBD further changes here.

***Add the following entries to Table 8-86 BSS membership selector value encoding:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | **Value** | **Feature** | **Interpretation** |  |
|  | 125 | GLK | Support for the mandatory features of Clause TBD is required in order to join the BSS that was the source of the Supported Rates element or Extended Supported Rates element containing this value. |  |
|  | 124 | EPD | Support for EPD is required in order to join the BSS that was the source of the Supported Rates element or Extended Supported Rates element containing this value. |  |
|  |  |  |  |  |

#### DMG Capabilities element

##### General

##### DMG STA Information Capability element

***Change Figure 8-499 as follows:***

Reverse Direction

B0 B1 B2 B3 B4 B5 B6 B7 B13

**Figure 8-499—DMG STA Capability Information field format**

TPC

SPSH and Interference Mitigation

Fast Link Adaptation

Total Number of Sectors

Higher Layer Timer Synchronization

Number of RX DMG Antennas

RXSS Length

B14 B19 B20 B21 B26 B27 B28 B51 B52 B53

DMG Antenna Reciprocity

Supported MCS Set

BA with Flow Control

DTP Supported

A-MPDU Parameters

A-PPDU Supported

B54 B55 B56 B57 B59 B60 B61 B62 B63

Heartbeat

Antenna Pattern Reciprocity

EPD ~~GLK~~

Supports Other\_AID

Heartbeat Elapsed Indication

RXSSTx- Rate Supported

Bit: 1 1 1 1 2 1 7

Bit: 6 1 6 1 24 1 1

Grant Ack Supported

Reserved

Bit: 1 1 1 3 1 1 1 1

***Change at the end of Clause 8.4.2.127.2:***

A DMG STA sets the ~~GLK~~EPD sub-field in the DMG Capabilities Information field to 1 when dot11G~~eneralLink~~EPDImplemented is true and sets it to 0 otherwise.

#### Relay Capabilities element

***Change Figure 8-537 as follows:***

Relay Supportability

Bits: 1 1 1 1 1 1 1 1 1

**Figure 8-537—Relay Capability Information field format**

Relay Usability

A/C Power

Cooperation

Reserved

B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 B15

Relay Permission

Relay Preference

Duplex

EPD ~~GLK~~

***Change the following text at the end of Clause 8.4.2.147:***

A DMG STA sets the ~~GLK~~EPD sub-field in the Relay Capabilities Information field to 1 when dot11~~GeneralLink~~EPDImplemented is true and sets it to 0 otherwise.

***Add new clause 8.4.2.171 as follows:***

#### GLK Capabilities element

The presence of the GLK Capabilities element, as shown in Figure 8-575a, in a Beacon, Probe, Probe Response, Associate, Association Response, Re-Associate, Reassociation Response, Mesh Peering Open, or Mesh Peering Confirm indicates that the transmitting STA is a GLK STA and indicates what additional GLK capabilities it may have if any.

The Element ID and Length fields are defined in 8.4.2.1.

The Length field for this element is tbd.

The flag bits are as show in Figure 8-575b.

Figures 8-575a and 575b TBD.

# MAC sublayer functional description

# MLME

## GLK BSS Operation

***Replace clause 10.45 with the following:***

GLK STAs advertise themselves as such through the use of the GLK Capabilities element (see 8.4.2.127.2). For a GLK STA, dot11GeneralLinkImplemented is true. For a non-GLK station, dot11GeneralLinkImplemented is false or absent.

# MLME Mesh procedures

## 13.11 Mesh Interworking ~~with the DS~~

### 13.11.1 Over of Mesh Interworking ~~between a mesh BSS and a DS~~

# Annex C, ASN.1 encoding of the MAC and PHY MIB

***Change entry being added at the end of the* dot11StationConfigEntry SEQUENCE*:***

dot11GeneralLinkImplemented TruthValue

dot11EPDImplemented TruthValue