IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proposed resolutions to some LB258 comments | | | | |
| Date: 2022-05-13 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Jouni Malinen | Qualcomm |  |  | jouni@qca.qualcomm.com |
|  |  |  |  |  |

Abstract

This document proposes resolutions to the follow LB258 comments:

CID 1082 (MAC): Secure bit in EAPOL-Key frames

CID 1277 (SEC): H2E to SAE finite state machine (Visio figure)

CID 1278 (ED2): Consistent style for status code in SAE finite state machine (Visio figure)

CID 1699 (MAC): State changes on reassociation-to-same-BSS failure

CID 1813 (MAC): Applicability of management frame protection

r1 - updates based on comments from Mark Rison:

* another instance of <123> in Figure 12-4 for CID 1278
* additional detail and an alternative resolution for CID 1699
* additional NOTE in CID 1082 option B
* some cleanup for CIDs 1277 and 1813

r2: CID 1082: additional change in 12.7.4

r3: Updates during the 2022-05-13 meeting slot (all five CIDs ready-for-motion)

# Comments

## CID 1082

12.7.2 P3206 L7

Comment:

make it unambiguous which PTK we're talking about

Proposed Change:

insert "initial" before PTK

Discussion:

SEC: 2022-04-11 15:48:11Z - status set to: Submission Required  
  
The cited text with the proposed change in redline is:  
  
"The Supplicant shall set the Secure bit to 0 in all EAPOL-Key frames it sends before it has the initial PTK and the GTK and before it has received an EAPOL-Key frame from the Authenticator with the Secure bit equal to 1 (this should be before receiving message 3 of the 4-way handshake). The Supplicant shall set the Secure bit to 1 in all EAPOL-Key frames sent after this until it loses the security association it shares with the Authenticator."  
  
Previously reviewed in CID 179 and CID 180 - 11-21/829

Minutes:

* + 1. CID 1082 (SEC)
       1. Review comment
       2. Discussion on when to set the secure bit.
       3. Concern on remembering what we agreed in the past, and this change will make it clear, but we need to make sure it is what we wanted to have happen. Concern with legacy devices.
       4. Need to make sure we are consistent with changes for CID 179 and 180 in doc 11-21/829r10
          1. Resolution for CID 179 and 180:

REJECTED (SEC: 2022-01-07 17:14:58Z) - The group could not come to consensus on a set of changes to the draft that would satisfy the commenter. The group discussed changes to address the comment in <https://mentor.ieee.org/802.11/dcn/21/11-21-0829-10-000m-resolutions-for-some-comments-on-11me-d0-0-cc35.docx> and ran the following straw poll:

Do you agree to resolve CIDs 179/180 with the text changes provided in document 11-21/829r10 limited to the handshake analyis clause (12.7.6.8)?

A.Yes 1

B.No 4

C.Abs 4

* + - 1. While we did not accept the document, we can review the discussion in rejecting the document.
      2. More work offline may need to be done.
      3. Assign to Jouni MALINEN and mark submission required.

CIDs 179 and 180 pointed out a confusing description of how EAPOL-Key msg 3/4 differs from msg 2/4 and 4/4. The proposed changes to address these comments in 829r10 went through significantly larger scope of issues related to the way the 4-way handshake and the group key handshake are described.

The context for the Secure bit and the proposed change in the comment is shown below:

REVme/D1.2 P3210 L25-36:

**12.7.2 EAPOL-Key frames**

...

7) Secure (bit 9) is set to 1 once the initial key exchange is complete.

The Authenticator shall set the Secure bit to 0 in all EAPOL-Key frames sent before the Supplicant has the PTK and the GTK. The Authenticator shall set the Secure bit to 1 in all EAPOL-Key frames it sends to the Supplicant containing the last key needed to complete the Supplicant’s initialization.

The Supplicant shall set the Secure bit to 0 in all EAPOL-Key frames it sends before it has the initial PTK and the GTK and before it has received an EAPOL-Key frame from the Authenticator with the Secure bit equal to 1 (this should be before receiving message 3 of the 4-way handshake). The Supplicant shall set the Secure bit to 1 in all EAPOL-Key frames sent after this until it loses the security association it shares with the Authenticator.

...

The current draft text here (and the earlier forms of it starting from IEEE Std 802.11i-2004) are somewhat unclear. The term "initial key exchange" is not defined. This might be referring to the first 4-way handshake in an association (which was the only option for deriving the PTK in IEEE Std 802.11i-2004) and potentially also to the use of FT protocol and FILS authentication where the PTK is derived during the authentication and association exchange, i.e., without using the 4-way handshake. It should also be noted that this tracking of state would be cleared when the association is lost.

"containing the last key needed to complete" is somewhat confusing. It might be referring to the EAPOL-Key msg 3/4 at the beginning of an association since that frame contains the GTK. However, it is not clear how this description of the Authenticator behavior would apply to any EAPOL-Key frame transmitted after the initial 4-way handshake (and even the first 4-way handshake in an association stated through FT protocol or FILS authentication).

"has the PTK" is unclear (like the comment pointed out) since EAPOL-Key frames are used to generate a new PTKSA during rekeying and that new PTKSA replaces the old PTKSA at the time it is created (since there can be only a single PTKSA between the Authenticator and the Supplicant per Key ID). This "the PTK" could be a reference the "initial PTK" like the comment is proposing, i.e., the first PTK derived for the association. Or it could be a reference to the PTK that is being derived in this instance of the 4-way handshake (i.e., the new PTKSA in case of rekeying).

"losing the security association" is unclear. The concept of "losing" an SA feels a bit strange. Furthermore, we have multiple different SAs. This might be referring to the PTKSA being deleted and if so, it has the same ambiguity with "the PTK" on which PTKSA is being deleted. Rekeying results in a PTKSA (the old one) getting deleted (with the exception of the first rekeying when Extended Key ID is used). That happens at the same point when the new PTKSA with the same Key ID is added. The text here might be interpreted to have to start setting the Secure bit to 0 in such case at the end of the rekeying 4-way handshake, but that would result in strange behavior since the new PTKSA is already available.

The following more detailed description of the 4-way handshake in 12.7.6 is significantly clearer on how the Secure bit is set, by indicating that it is 0 in msg 1/4 and 2/4 and 1 in msg 3/4 and 4/4 regardless of whether those messages are for the initial or rekeying cases.

**12.7.4 EAPOL-Key frame notation**

The following notation is used throughout the remainder of 12.7 (Keys and key distribution) and 13.4 (FT

initial mobility domain association) to represent EAPOL-Key frames:

EAPOL-Key(S, M, A, I, K, Reserved, KeyRSC, ANonce/SNonce, MIC, {Key Data})

where

S means the initial key exchange is complete; this is the Secure bit of the Key Information field

…

**12.7.6 4-way handshake**

**12.7.6.1 General**

RSNA defines a protocol using EAPOL-Key frames called the 4-way handshake. The handshake completes the IEEE 802.1X authentication process. The information flow of the 4-way handshake is as follows:

Message 1: Authenticator 🡪 Supplicant: EAPOL-Key(0,0,1,0,P,0,0,ANonce,0,{} or {PMKID})

Message 2: Supplicant 🡪 Authenticator: EAPOL-Key(0,1,0,0,P,0,0,SNonce,MIC,{RSNE} or

{RSNE, OCI KDE} or {RSNE, RSNXE} or {RSNE, OCI KDE, RSNXE})

Message 3: Authenticator 🡪 Supplicant:

EAPOL-Key(1,1,1,1,P,0,KeyRSC,ANonce,MIC,{RSNE,GTK[N]} or

{RSNE, GTK[N], OCI KDE} or {RSNE, GTK[N], RSNXE} or

{RSNE, GTK[N], OCI KDE, RSNXE})

Message 4: Supplicant 🡪 Authenticator: EAPOL-Key(1,1,0,0,P,0,0,0,MIC,{}).

**12.7.6.2 4-way handshake message 1**

Message 1 uses the following values for each of the EAPOL-Key frame fields:

Descriptor Type = N – see 12.7.2 (EAPOL-Key frames)

Key Information:

Key Descriptor Version = 1 (ARC4 encryption with HMAC-MD5) or 2 (NIST AES key wrap with HMAC-SHA-1-128) or 3 (NIST AES key wrap with AES-128-CMAC), in all other cases 0

Key Type = 1 (Pairwise)

Reserved = 0

Install = 0

Key Ack = 1

Key MIC = 0

Secure = 0

…

In addition to the unclear description in the standard, it should be noted that there are deployed implementations that set the Secure bit value in identical way between the first 4-way handshake (the one that is used to derive the first PTKSA for the association) and the 4-way handshake that is used to rekey the PTK during an association. This matches the description in 12.7.6, but could be interpreted to differ from the one in 12.7.2. It would be problematic if we were to modify the standard at this point to make such implementations non-compliant and potentially imply that new implementations should discard the EAPOL-Key msg 2/4 from them during rekeying 4-way handshake. As such, if we decide to change something, it should be done in a manner that either allows this deployed functionality or at least notes that such behavior is used.

It is also not clear what the actual purpose and use of the Secure bit is. The standard does not seem to describe any particular behavior that would differ on the Authenticator or the Supplicant based on whether this bit is set to 0 or 1. It is not clear why it would be valuable for any 3rd party observer of the EAPOL-Key frames either.

All this seems to point towards us needing to determine do we want to clean this set of three paragraphs now, 18 years after they were introduced in IEEE Std 802.11i-2004. The text looks clearly ambiguous and potentially incorrect or at least misleading. That would seem to justify some work here. However, it is not clear that we can find an acceptable version of the text taken into account the potentially conflicting statements in this area in the standard and also taking into account the behavior in significant set of deployed devices. We may need to acknowledge that there is nothing that can really be done at this point to make the behavior for the Secure bit in messages 1 and 2 of 4-way handshake consistent for any other case than the initial 4-way handshake and note that implementors will need to ignore the value of this bit in other cases to avoid interoperability issues.

If we were to want to clarify this behavior to the direction of the Secure bit indicating that there is a shared PTKSA in general, the changes could be something like following in this location. However, this would also require changing a number of locations within 12.7.6 to cover the different behavior between the initial and rekeying 4-way handshakes.

### CID 1082 changes - option A

*Modify 12.7.2 (REVme/D1.2 P3210 L25-36) as follows:*

**12.7.2 EAPOL-Key frames**

...

7) Secure (bit 9) indicates whether the Authenticator and the Supplicant share a PTKSA. It is set to 0 in messages 1 and 2 of the 4-way handshake if the Authenticator and the Supplicant do not share a PTKSA. Otherwise, it is set to 1.

NOTE—Some deployed Authenticator and Supplicant implementations set the Secure bit to 0 in messages 1 and 2 of the 4-way handshake that is used for PTK rekeying even when they already share a previously generated PTKSA. In the interests of interoperability, implementations might ignore the Secure bit in received frames.

...

*Modify 12.7.4 (REVme/D1.2 P3219 L2) as follows:*

**12.7.4 EAPOL-Key frame notation**

The following notation is used throughout the remainder of 12.7 (Keys and key distribution) and 13.4 (FT

initial mobility domain association) to represent EAPOL-Key frames:

EAPOL-Key(S, M, A, I, K, Reserved, KeyRSC, ANonce/SNonce, MIC, {Key Data})

where

S is the Secure bit of the Key Information field

M means the MIC is available in message. This should be set in all messages

except message 1 of a 4-way handshake. This is the Key MIC bit of the Key

Information field. When the negotiated AKM is 00-0F-AC:14, 00-0F-AC:15, 00-0FAC:

16, or 00-0F-AC:17, this Key MIC bit is set to 0 regardless of the M parameter

value.

A means a response is required to this message. This is used when the receiver should

respond to this message. This is the Key Ack bit of the Key Information field.

I is the Install bit: indicates whether to install (1) or not install (0) for the pairwise key.

This is the Install bit of the Key Information field.

K is the key type: P (Pairwise), G (Group); this is the Key Type bit of the Key

Information field

...

If we were to want to clarify this behavior to the direction of the Secure bit being used as it is in 12.7.6, i.e., without making any difference between initial and rekeying exchanges, the changes could be something like following in this location. This would likely not need changes within 12.7.6.

### CID 1082 changes - option B

*Modify 12.7.2 (REVme/D1.2 P3210 L25-36) as follows:*

**12.7.2 EAPOL-Key frames**

...

7) Secure (bit 9) is set to 0 in messages 1 and 2 of the 4-way handshake and to 1 in other messages.

NOTE—Some deployed Authenticator and Supplicant implementations set the Secure bit to 1 in the messages 1 and 2 of the 4-way handshake that is used for rekeying the PTK during an association.

...

*Modify 12.7.4 (REVme/D1.2 P3219 L2) as follows:*

**12.7.4 EAPOL-Key frame notation**

The following notation is used throughout the remainder of 12.7 (Keys and key distribution) and 13.4 (FT

initial mobility domain association) to represent EAPOL-Key frames:

EAPOL-Key(S, M, A, I, K, Reserved, KeyRSC, ANonce/SNonce, MIC, {Key Data})

where

S is the Secure bit of the Key Information field

M means the MIC is available in message. This should be set in all messages

except message 1 of a 4-way handshake. This is the Key MIC bit of the Key

Information field. When the negotiated AKM is 00-0F-AC:14, 00-0F-AC:15, 00-0FAC:

16, or 00-0F-AC:17, this Key MIC bit is set to 0 regardless of the M parameter

value.

A means a response is required to this message. This is used when the receiver should

respond to this message. This is the Key Ack bit of the Key Information field.

I is the Install bit: indicates whether to install (1) or not install (0) for the pairwise key.

This is the Install bit of the Key Information field.

K is the key type: P (Pairwise), G (Group); this is the Key Type bit of the Key

Information field

...

## CID 1274 (PLACEHOLDER - NO NEED TO DISCUSS)

11.2.3.16.3 P2715 L5

Comment:

The design for delivering the GTK to a STA waking up from WNM sleep mode does not seem to work correctly for the case where RSN is used without management frame protection. This does not cover the case where there is a pending GTK update in progress (which is defined in the same paragraph for the management frame protection case) and as such, the STA could be left without knowing the new GTK when the AP/Authenticator takes that into use. The current text is as follows: "If RSN is used without management frame protection and a valid PTK is configured for the STA, the current GTK shall be sent to the STA using a group key handshake (see 12.7.7 (Group key handshake)) immediately following the WNM Sleep Mode Response frame."

Proposed Change:

Add after the cited sentence (i.e., at the end of the paragraph): "If a GTK update is in progress, the pending GTK shall be sent to the STA using another group key handshake immediately after the current GTK has been sent."

Resolution: (NOTE: Already discussed and database has a proposed resolution)

REVISED (MAC: 2022-04-27 18:14:06Z): Make the Proposed Change. Also, add a paragraph break after the second sentence in the cited paragraph.

Discussion:

This comment was apparently marked ready for motion, so no need to address in this document.

MAC: 2022-05-02 23:08:11Z - status set to: Ready for Motion

* + 1. CID 1274 (MAC)
       1. Review comment
       2. Discussion on when RSN is used.
       3. Looking at the paragraph, you have “If RSN is used with management” and another sentence of “If RSN is used without management” and some other side sentences, so we should put a paragraph break prior to the “If RSN is used without management” sentence.
       4. So, we add the new paragraph point and the requested sentence.
       5. Proposed Resolution: REVISED (MAC: 2022-04-27 18:14:06Z): Make the Proposed Change. Also, add a paragraph break after the second sentence in the cited paragraph.
       6. No Objection – Mark Ready for Motion

## CID 1277

**Owning Adhoc**: SEC

12.4.8 P3120

Comment:

12.4.8 (SAE finite state machine) subclauses were not updated to know about the new special status code value 126 for H2E. It is used similarly to the value 0 as a success case instead of other nonzero values indicating failures.

Proposed Change:

In Figure 12-4 (P3120 L7, 12.4.8.1):  
Replace "1(0)" with "1(0 or 126)" in Nothing->Committed.  
Replace "1(0)" with "1(0 or 126)" in Nothing->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Confirmed->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Committed->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Committed->Committed (5 instances).  
  
At P3121 L46 (12.4.8.3.2), replace "Com. Indicates receipt of an SAE Commit message (authentication transaction sequence number 1) with a status of 0." with "Com. Indicates receipt of an SAE Commit message (authentication transaction sequence number 1) with a status of 0 or 126."  
  
At P3124 L30 (12.4.8.6.3), replace "Status code is not SUCCESS" with "Status code is not SUCCESS or SAE\_HASH\_TO\_ELEMENT".  
  
At P3125 L18 (12.4.8.6.4), replace "If the Status is some other nonzero value" with "If the Status is some other nonzero value other than 126".  
  
At P3125 L20 (12.4.8.6.4), replace "If the Status is zero" with "If the Status is 0 or 126".

Discussion:

SEC: 2022-01-12 20:02:28Z - status set to: Submission Required

**Earlier proposed comment resolution for CID 1277; see below for an updated proposal using the redline edits in this document.**

Revised. In Figure 12-4 (P3120 L7, 12.4.8.1):  
Replace "1(0)" with "1(0 or 126)" in Nothing->Committed.  
Replace "1(0)" with "1(0 or 126)" in Nothing->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Confirmed->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Committed->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Committed->Committed (5 instances).  
  
At P3121 L46 (12.4.8.3.2), replace "Com. Indicates receipt of an SAE Commit message (authentication transaction sequence number 1) with a status of 0." with "Com. Indicates receipt of an SAE Commit message (authentication transaction sequence number 1) with a status of 0 or 126."  
  
At P3124 L30 (12.4.8.6.3), replace "Status code is not SUCCESS" with "Status code is not SUCCESS or SAE\_HASH\_TO\_ELEMENT".  
  
At P3125 L18 (12.4.8.6.4), replace "If the Status is some other nonzero value" with "If the Status is not 0 or 126".  
  
At P3125 L20 (12.4.8.6.4), replace "If the Status is zero" with "If the Status is 0 or 126".

At P3126 L22 (12.4.8.6.5), replace "If the Status is nonzero, the frame shall be silently discarded, the t0 (retransmission) timer set, and the protocol instance shall remain in the Confirmed state." with "If the Status is not 0 or 126, the frame shall be silently discarded, the t0 (retransmission) timer set, and the protocol instance shall remain in the Confirmed state."

Note to editors: Figure 12-4 is Figure 12-15 in REVme/D1.2 and the Visio source of the figure with the proposed changes in attached in <this document>.

**Proposed comment resolution for CID 1277**

REVISED. Make the changes marked as "The proposed changes for CID 1277" in <this document>. This changes the text to the direction proposed in the comment and includes additional cleanup to address items that came up while reviewing the exact changes.

**The proposed changes for CID 1277 – START**

*Modify Figure 12-4 (Figure 12-15 in D1.2) in 12.4.8.3.1 as follows:*

Replace "1(0)" with "1(0 or 126)" in Nothing->Committed.  
Replace "1(0)" with "1(0 or 126)" in Nothing->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Confirmed->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Committed->Confirmed.  
Replace "1(0)" with "1(0 or 126)" in Committed->Committed (5 instances).  
Note to editors: Figure 12-4 is Figure 12-15 in REVme/D1.2 and the Visio source of the figure with the proposed changes are attached below. Also note that CID 1278 modifies the same figure and combined edits as a Visio source are also attached below.

*Modify 12.4.8.3.2 as shown:*

**12.4.8.3.2 Protocol instance events and output**

The protocol instance receives events from the parent SAE process.

— *Com.* Indicates receipt of an SAE Commit message (authentication transaction sequence number 1) with a status of 0 or 126.

— *Con.* Indicates receipt of an SAE Confirm message (authentication transaction sequence number 2) with a status of 0.

*Modify 12.4.8.6.3 as shown:*

**12.4.8.6.3 Protocol instance behavior—Nothing state**

In *Nothing* state a protocol instance has just been allocated.

Upon receipt of an *Init* event, the protocol instance shall zero its *Sync* variable, *Rc*, and *Sc* variables, select a group from local configuration and generate the ***PWE*** and the secret values according to 12.4.5.2 (PWE and secret generation), generate an SAE Commit message (see 12.4.5.3 (Construction of an SAE Commit message)), and set its t0 (retransmission) timer. The protocol instance transitions into *Committed* state.

Upon receipt of a *Com* event, the protocol instance shall check the Status of the Authentication frame. If the Status code is not SUCCESS or SAE\_HASH\_TO\_ELEMENT, the frame shall be silently discarded and a *Del* event shall be sent to the parent process. Otherwise, the frame shall be processed by first checking whether a password identifier is present. If so and there is no password associated with that identifier, *BadID* shall be set and the protocol instance shall construct and transmit an Authentication frame with Status Code set to UNKNOWN\_PASSWORD\_IDENTIFIER. If there is no password identifier present or if a password is associated with that identifier, the frame shall be processed by next checking the finite cyclic group field to see if the requested group is supported. If not, *BadGrp* shall be set and the protocol instance shall construct and transmit an Authentication frame with Status code UNSUPPORTED\_FINITE\_CYCLIC\_GROUP indicating rejection with the finite cyclic group field set to the rejected group, and shall send the parent process a *Del* event. If the group is supported, the protocol instance shall zero the *Sc* and *Rc* counters and it shall generate the ***PWE*** and the secret values according to 12.4.5.2 (PWE and secret generation). It shall then process the received SAE Commit message (see 12.4.5.4 (Processing of a peer’s SAE Commit message)). If validation of the received SAE Commit message fails, the protocol instance shall send a Del event to the parent process; otherwise, it shall construct and transmit an SAE Commit message (see 12.4.5.3 (Construction of an SAE Commit message)), increment Sc, and construct and transmit an SAE Confirm message (see 12.4.5.5 (Construction of an SAE Confirm message)). The *Sync* counter shall be set to 0 and the t0 (retransmission) timer shall be set. The protocol instance transitions to *Confirmed* state.

*Modify 12.4.8.6.4 as shown:*

**12.4.8.6.4 Protocol instance behavior—Committed state**

In *Committed* state, a protocol instance has sent its peer an SAE Commit message but has yet to receive (and accept) anything.

Upon receipt of a *Com* event, the t0 (retransmission) timer shall be canceled. Then the following is performed:

— The protocol instance shall check the Status code of the Authentication frame.

— If the Status code is ANTI\_CLOGGING\_TOKEN\_REQUIRED, a new SAE Commit message shall be constructed with the Anti-Clogging Token field from the received Authentication frame, and the *commit-scalar* and ***COMMIT-ELEMENT*** previously sent. The new SAE Commit message shall be transmitted to the peer, *Sync* shall be zeroed, and the t0 (retransmission) timer shall be set.

— If the Status code is UNKNOWN\_PASSWORD\_IDENTIFIER, the protocol instance shall send a

Del event to the parent process and transition back to Nothing state.

— If the Status code is UNSUPPORTED\_FINITE\_CYCLIC\_GROUP, the protocol instance shall

check the finite cyclic group field being rejected. If the rejected group does not match the last

offered group the protocol instance shall silently discard the message and set the t0 (retransmission)

timer. If the rejected group matches the last offered group, the protocol instance shall choose a

different group and generate the ***PWE*** and the secret values according to 12.4.5.2 (PWE and secret

generation); it then generates and transmits a new SAE Commit message to the peer, zeros *Sync*, sets the t0 (retransmission) timer, and remains in *Committed* state. If there are no other groups to choose, the protocol instance shall send a *Del* event to the parent process and transitions back to *Nothing* state.

— If the Status code is some other value that is neither SUCCESS nor SAE\_HASH\_TO\_ELEMENT, the frame shall be silently discarded and the t0 (retransmission) timer shall be set.

— If the Status code is SUCCESS or SAE\_HASH\_TO\_ELEMENT, the finite cyclic group field is checked. If the group is not supported, *BadGrp* shall be set and the value of *Sync* shall be checked.

— If *Sync* is greater than dot11RSNASAESync, the protocol instance shall send a *Del* event to the

parent process and transitions back to *Nothing* state.

— If *Sync* is not greater than dot11RSNASAESync, *Sync* shall be incremented, an SAE Commit

message with Status code equal to UNSUPPORTED\_FINITE\_CYCLIC\_GROUP indicating

rejection, and the Algorithm identifier set to the rejected algorithm shall be sent to the peer, the

t0 (retransmission) timer shall be set and the protocol instance shall remain in *Committed* state.

— If there is a password identifier associated with the password when the protocol instance constructed its SAE Commit message and either there is no password identifier in the received frame or the password identifier in the received frame does not match the password identifier used to construct the protocol instance’s SAE Commit message, *BadID* shall be set, the protocol instance shall send a Del event to the parent process and transition back to Nothing state.

— If the group is supported but does not match that used when the protocol instance constructed its

SAE Commit message, *DiffGrp* shall be set and the local identity and peer identity shall be checked.

— The mesh STA, with the numerically greater of the two MAC addresses, drops the received SAE Commit message, retransmits its last SAE Commit message, and shall set the t0 (retransmission) timer and remain in *Committed* state.

— The mesh STA, with the numerically lesser of the two MAC addresses, shall set *Sync* to zero, increment *Sc*, choose the group from the received SAE Commit message, generate new ***PWE*** and new secret values according to 12.4.5.2 (PWE and secret generation), process the received SAE Commit message according to 12.4.5.4 (Processing of a peer’s SAE Commit message), generate a new SAE Commit message and SAE Confirm message, and transmit the new Commit and Confirm to the peer. It shall then transition to *Confirmed* state.

— If the group is supported and matches that used when the protocol instance constructed its SAE Commit message, the protocol instance checks the *peer-commit-scalar* and ***PEER-COMMIT-ELEMENT*** from the message. If they match those sent as part of the protocol instance’s own SAE

Commit message, the frame shall be silently discarded (because it is evidence of a reflection attack) and the t0 (retransmission) timer shall be set. If the received element and scalar differ from the

element and scalar offered, the received SAE Commit message shall be processed according to

12.4.5.4 (Processing of a peer’s SAE Commit message), the *Sc* counter shall be incremented

(thereby setting its value to one), the protocol instance shall then construct an SAE Confirm message, transmit it to the peer, and set the t0 (retransmission) timer. It shall then transition to

*Confirmed* state.

If the t0 (retransmission) timer fires, the value of the *Sync* counter is checked. If *Sync* is greater than

dot11RSNASAESync, the protocol instance shall send a *Del* event to the parent process and transition back to *Nothing* state. If *Sync* is not greater than dot11RSNASAESync, the *Sync* counter shall be incremented, the last message sent shall be sent again, and the t0 (retransmission) timer shall be set.

Upon receipt of a *Con* event, the protocol instance checks the value of *Sync*. If it is greater than

dot11RSNASAESync, the protocol instance shall send a *Del* event to the parent process and transition back to *Nothing* state. If *Sync* is not greater than dot11RSNASAESync, the protocol instance shall transmit the last SAE Commit message sent to the peer.

*Modify 12.4.8.6.5 as shown:*

**12.4.8.6.5 Protocol instance behavior—Confirmed state**

In *Confirmed* state, a protocol instance has sent its peer an SAE Commit message and SAE Confirm message. It has received an SAE Commit message from its peer.

Rejection frames received in Confirmed state shall be silently discarded.

Upon receipt of a *Com* event, the t0 (retransmission) timer shall be canceled. If the Status is not 0 or 126, the frame shall be silently discarded, the t0 (retransmission) timer set, and the protocol instance shall remain in the *Confirmed* state. Otherwise, if *Sync* is greater than dot11RSNASAESync, the protocol instance shall send the parent process a *Del* event and transitions back to *Nothing* state. Otherwise, if the finite cyclic group differs from the finite cyclic group in the most recently received valid SAE Commit message, the t0 (retransmission) timer shall be set and the frame shall be silently discarded. Otherwise, the protocol instance shall increment *Sync*, increment *Sc*, transmit its SAE Commit message and its SAE Confirm message with the new *Sc* value, and set the t0 (retransmission) timer.

Upon receipt of a *Con* event, the SAE Confirm message shall be processed according to 12.4.5.6 (Processing of a peer’s SAE Confirm message). If processing is unsuccessful and the SAE Confirm message is not verified, protocol instance shall remain in Confirmed state. If processing is successful and the SAE Confirm message has been verified, the *Rc* variable shall be set to the value of the Send-Confirm field, *Sc* shall be set to the value 216 – 1, the t1 (key expiration) timer shall be set, the t0 (retransmission) timer shall be canceled, and the protocol instance shall transition to *Accepted* state.

If the t0 (retransmission) timer fires, the value of the *Sync* counter shall be checked. If *Sync* is greater than dot11RSNASAESync, the protocol instance shall send a *Del* event to the parent process and transition back to *Nothing* state. If *Sync* is not greater than dot11RSNASAESync, the *Sync* counter shall be incremented, *Sc* shall be incremented, and the protocol instance shall create an SAE Confirm message with the new *Sc* value, transmit it to the peer, and set the t0 (retransmission) timer.

**The proposed changes for CID 1277 - END**

## CID 1278

**Owning Adhoc**: ED2

12.4.8.1 P3120 L5

Comment:

The SAE Password Identifier mismatch case in Figure 12-4 (SAE finite state machine) uses inconsistent style in indicating the Authentication frame Status Code field value: "<123>" while all other cases use only the integer value in the 1(N) event.

Proposed Change:

Replace "1(<123>)" with "1(123)" in Nothing->Nothing transition of Figure 12-4.

Discussion

ED2: 2022-01-15 12:13:34Z - status set to: Submission Required

**Proposed comment resolution for CID 1278**

Revised. Replace "1(<123>)" with "1(123)" in Nothing->Nothing transition and "Rej(<123>)" with "Rej(123)" in Committed->Nothing transition of Figure 12-4.

Note to editors: Figure 12-4 is Figure 12-15 in REVme/D1.2 and the Visio source of the figure with the proposed changes is attached in <this document>. Also note that CID 1277 modifies the same figure and combined edits as a Visio source are also attached in <this document>.

For discussion/reference:

Visio file with CID 1277 changes:



Visio file with CID 1278 changes:



Visio file with both CID 1277 and 1278 changes:



## CID 1699

**Owning Adhoc**: MAC

**Location**: 11.3.5

**Comment**

It is unfortunate that the current association is lost at the non-AP STA if reassociation to the same AP fails, and the SA is lost at the AP

**Proposed Change**

In 11.3.5.4 add a NOTE after f)1) saying "NOTE---This means the STA is disassociated in case of failure of reassociation to the same AP." In 11.3.5.5 add a NOTE after n) saying "NOTE---This means the STA remains associated but loses any security association in case of failure of reassociation to the same AP."

**Discussion**

This was discussed 2022-01-18:

* + 1. CID 1699 (MAC)
       1. Review comment
       2. Review the proposed change.
       3. Discussion on relevance of Note 2 being added.
       4. The comment seems to need more work, the proposed change was not immediately accepted.
       5. More work to resolve the CID. Mark Submission Required.
       6. Assign CID to Jouni MALINEN

MAC: 2022-01-18 22:58:50Z - Some belief that remaining associated is actually incorrect. More work needed.

Regarding the non-AP STA behavior, 11.3.5.4 is quite cleaer that the PTKSA shall be deleted before sending out the Reassociation Request frame. As such, there is no way to recover the previous state of the association if the reassociation attempt were to fail. This means that it is appropriate for the non-AP STA to drop its association state when receiving the Reassociation Response frame with nonzero status code: see 11.3.5.4, f) 1) and the NOTE proposed by the comment seems reasonable to add.

Regarding the AP behavior, the rules need to be different since the AP has to protect against attackers using injected Reassociation Request frames trying to terminate an existing association that has management frame protection enabled. The NOTE proposed by the comment for this case is not correct in the context of this subclause; the AP is dropping the SAs only in case of a successful reassociation. Failed reassociation does change the State from 4 to 3, though, when management frame protection is not in use and the reassociation is not part of fast BSS transition. This move to State 3 (while maintaining possible SAs) is not exactly ideal for the no-attacker case. However, the non-AP STA would move to State 2 in this case, so there is only limited impact from this to observable behavior. It does not seem necessary to add any note into 11.3.5.5 especially since the hopefully more reasonable case of management frame protection is described quite clearly not to change any state.

All that said about the AP behavior, there actually seems to be ambiguity in the standard on the exact AP behavior on reassociation when management frame protection is not used. 12.6.18 (RSNA security association termination) indicates that the AP drops the SAs on reception of an MLME-REASSOCIATE.indication from a STA that has not negotiated management frame protection. This is not conditional on the result of that reassociation and as such, this does not match what 11.3.5.5 says (delete only in success case). While both these subclauses are normative, the subclause within Clause 12 (Security) feels like a more authoritative description of the required behavior. We could consider updating 11.3.5.5 to match the requirement in 12.6.18 to get rid of the ambiguity.

The applicable part of REVme/D1.2 12.6.18 for reference:

**12.6.18 RSNA security association termination**

When a non-AP STA’s SME receives a successful MLME-ASSOCIATE.confirm or MLME-REASSOCIATE.confirm primitive that is not part of a fast BSS transition or receives or invokes an

MLME Disassociation or Deauthentication primitive, it deletes some security associations. Similarly, when an AP’s SME

— Receives an MLME-ASSOCIATE.indication or MLME-REASSOCIATE.indication primitive from

a STA that has not negotiated management frame protection, or

— Receives an MLME-ASSOCIATE.indication or MLME-REASSOCIATE.indication primitive from

a STA that has negotiated management frame protection that a) has resulted in an MLME

(re)association response that is successful, and b) is not part of a fast BSS transition, or receives an

MLME-DEAUTHENTICATE.indication or MLME-DISASSOCIATE.indication primitive or

issues an MLME-DEAUTHENTICATE.request or MLME-DISASSOCIATE.request primitive,

it deletes some security associations. In the case of an ESS, the non-AP STA’s SME shall delete the PTKSA, GTKSA, any IGTKSA, any BIGTKSA, WIGTKSA, and any TPKSA, and the AP’s SME shall delete the PTKSA. In the case of an IBSS, the SME shall delete the PTKSA and the receive GTKSA and any IGTKSA. Once the security associations have been deleted, the SME then invokes the MLME-DELETEKEYS.request primitive to delete all temporal keys associated with the deleted security associations.

It would also be possible to consider changing the behavior of the failed reassociation-to-the-same-AP, i.e., an attempt to change some of the previously negotiated parameters, to maintain the previous state as-is and neither change the State value (i.e., leave in State 4) nor drop any SAs. This might be somewhat problematic, though, from the view point of existing deployed implementations and the non-AP STA not knowing what will happen with any particular AP. In any case, this option seems to go way beyond the scope of this comment and is something that should likely be considered separately during the recirculation ballot. This document does not current propose any specific changes for this option.

The changes proposed in the comment on top of the REVme/D1.2 text

**11.3.5.4 Non-AP and non-PCP STA reassociation initiation procedures**

Except when the association is part of a fast BSS transition, the SME shall delete any PTKSA, GTKSA, IGTKSA, BIGTKSA, WIGTKSA, and TPKSA (including temporal keys) held for communication with the AP or PCP by using the MLME-DELETEKEYS.request primitive (see 12.6.18 (RSNA security association termination)) before invoking an MLME-REASSOCIATE.request primitive.

If dot11InterworkingServiceActivated is true and the STA was associated to the ESS for unsecured access to emergency services, the SME shall submit the MLME-REASSOCIATE.request primitive with EmergencyServices parameter set to true.

The MM-SME of a non-AP and non-PCP STA may include an MMS element in an MLME-REASSOCIATE.request primitive. The MM-SME shall include in the MMS element the MAC address associated with the MLME SAP instance to which the primitive is submitted.

Upon receipt of an MLME-REASSOCIATE.request primitive that is part of an on-channel tunneling (see 11.31.5 (On-channel Tunneling (OCT) operation)), a non-AP and non-PCP STA shall follow the rules in 11.31.5 (On-channel Tunneling (OCT) operation) in addition to the reassociation procedures described below.

Upon receipt of an MLME-REASSOCIATE.request primitive, a non-AP and non-PCP STA shall reassociate with an AP or PCP using the following procedure:

a) If the STA is not associated in the same ESS or the state for the new AP or PCP is State 1, the MLME shall inform the SME of the failure of the reassociation by issuing an MLME-REASSOCIATE.confirm primitive, and this procedure ends.

b) The MLME shall transmit a Reassociation Request frame to the new AP or PCP. The RSNE contained in the MLME-ASSOCIATE.request primitive shall be included in the Reassociation Request frame. The RSNE shall specify exactly one pairwise cipher suite and exactly one AKM suite. If the MLME-REASSOCIATE.request primitive contained the EmergencyServices parameter equal to true, an Interworking element with the UESA field set to 1 shall be included in the Reassociation Request frame.

c) If a Reassociation Response frame is received with a status code of SUCCESS, the state variable for the new AP or PCP shall be set to State 4 or to State 3 if dot11RSNAActivated is true and the FT protocol is not used with respect to the new AP or PCP and, unless the old AP or PCP and new AP or PCP are the same, to State 2 with respect to the old AP or PCP, and the MLME shall issue an MLME-REASSOCIATE.confirm primitive to inform the SME of the successful completion of the reassociation.

If the MLME-REASSOCIATION.request primitive has the new AP’s or PCP’s MAC address in the CurrentAPAddress parameter (reassociation to the same AP or PCP), the following states, agreements, and allocations shall be deleted or reset to initial values:

1) All EDCAF state

2) Any block ack agreements that are not GCR agreements

3) Sequence number

4) Packet number

5) Duplicate detection caches

6) Anything queued for transmission

7) Fragmentation and reassembly buffers

8) Power management mode

9) WNM sleep mode

10) TPKSAs established with any peers

11) TSPECs

12) DMG TSPECs

13) GLK-GCR agreement

14) MSCS

15) SCS

If the reassociation is to the same AP (as described above), the following states, agreements, and allocations are not affected by the reassociation procedure:

1) PSMP sessions

2) Enablement/Deenablement

3) GDD enablement

4) TDLS agreements

5) MMSLs

6) GCR agreements that are not GLK-GCR agreements

7) DMS agreements

8) TFS agreements

9) FMS agreements

10) Triggered autonomous reporting agreements

11) FTM sessions

12) DMG SP and CBAP allocations

13) PTP TSPECs

In the case of reassociation to a different AP or PCP (the CurrentAPAddress parameter is not the new AP’s or PCP’s MAC address), all the states, agreements and allocations listed above are deleted or reset to initial values.

d) If a Reassociation Response frame is received with a status code of SUCCESS, a DMG STA shall write to each of the following MIB attributes the corresponding subfield of the DMG BSS Parameter Configuration field of the DMG Operation element received from the AP or PCP to which it requested reassociation:

1) dot11PSRequestSuspensionInterval from the PSRequestSuspensionInterval subfield

2) dot11MinBHIDuration from the MinBHIDuration subfield

3) dot11BroadcastSTAInfoDuration from the BroadcastSTAInfoDuration subfield

4) dot11AssocRespConfirmTime from the AssocRespConfirmTime subfield

5) dot11MinPPDuration from the MinPPDuration subfield

6) dot11SPIdleTimeout from the SPIdleTimeout subfield

7) dot11MaxLostBeacons from the MaxLostBeacons subfield

e) If an Association Response frame is received with a status code of SUCCESS at an MM-SME coordinated STA and the Single AID field within the MMS element is equal to 1, then

— For each of its MAC entities advertised within the MMS element and for which dot11RSNAActivated is true, the state is set to State 3. Progress from State 3 to State 4 occurs independently in each such MAC entity.

— For each of its MAC entities advertised within the MMS element and for which dot11RSNAActivated is false, the state is set to State 4.

— For each of its MAC entities advertised within the MMS element the state for any other AP or PCP which is State 3 or State 4 prior to the association request shall be set to State 2.

f) If a Reassociation Response frame is received with a status code other than SUCCESS or the reassociation fails to complete within dot11AssociationResponseTimeout:

1) Except when the association is part of a fast BSS transition, the state for the AP or PCP shall be set to State 2 with respect to the new AP or PCP.

NOTE—This means the STA is disassociated in case of failure of reassociation to the same AP.

2) The MLME shall issue an MLME-REASSOCIATE.confirm primitive to inform the SME of the failure of the reassociation. The ResultCode returned in the MLME-REASSOCIATE.confirm primitive indicates the cause of the failed reassociation attempt. Any misconfiguration or parameter mismatch, e.g., data rates required as basic rates that the STA did not indicate as supported in the STA’s Supported Rates and BSS Membership Selectors element, shall be corrected before the SME issues an MLME-REASSOCIATE.request primitive for the same AP or PCP. If the status code indicates the reassociation failed because of a reason that is not related to configuration (e.g., the AP or PCP is unable to support additional associations) and the Reassociation Response frame does not include a Timeout Interval element with Timeout Interval Type equal to 3 the SME shall not issue an MLME-REASSOCIATE.request primitive for the same AP or PCP until a period of at least 2 s has elapsed. If the status code indicates the reassociation failed and the Reassociation Response frame contains a Timeout Interval element with Timeout Interval Type equal to 3, the SME shall not issue an MLME-REASSOCIATE.request primitive for the same AP or PCP until the period specified in the Timeout Interval element has elapsed.

g) If an MLME-REASSOCIATE.confirm primitive is received with a ResultCode of SUCCESS, and RSNA is required, and FILS authentication was not used, and the STA is in State 3, then the SME shall perform a 4-way handshake to establish an RSNA. As a part of a successful 4-way handshake, the SME shall enable protection by generating an MLME-SETPROTECTION.request(Rx\_Tx) primitive. If an MLME-REASSOCIATE.confirm primitive is received with a ResultCode of SUCCESS, and FILS authentication was used, and the STA is in State 3, then the SME shall enable protection by generating an MLME-SETPROTECTION.request(Rx\_Tx) primitive.

h) Upon receipt of the MLME-SETPROTECTION.request(Rx\_Tx) primitive, the MLME shall set the state of the STA to State 4.

**11.3.5.5 AP or PCP reassociation receipt procedures**

Upon receipt of a Reassociation Request frame from a STA the AP or PCP shall use the following procedure:

a) The MLME shall issue an MLME-REASSOCIATE.indication primitive to inform the SME of the reassociation request. The SME shall issue an MLME-REASSOCIATE.response primitive addressed to the STA identified by the PeerSTAAddress parameter of the MLME-REASSOCIATE.indication primitive. If the reassociation is not successful, the SME shall indicate a specific reason for the failure to reassociate in the ResultCode parameter. Upon receipt of the MLME-REASSOCIATE.response primitive, the MLME shall transmit a Reassociation Response frame.

b) If the state for the STA is State 1 and the STA is a non-DMG STA, the SME shall refuse the reassociation request by issuing an MLME-REASSOCIATE.response primitive with ResultCode NOT\_AUTHENTICATED.

c) AP with dot11InterworkingServiceActivated true only: If the MLME-REASSOCIATE.indication primitive has the EmergencyServices parameter set to true and the RSN parameter does not include an RSNE, the SME shall not reject the reassociation request on the basis that dot11RSNAActivated is true and dot11PrivacyInvoked is true thereby granting access, using unprotected frames (see 9.2.4.1.9 (Protected Frame subfield)), to the network for emergency services purposes.

d) Otherwise, in an RSNA the SME shall check the values received in the RSN parameter to see whether the values received match the security policy. If they do not, SME shall refuse the reassociation by issuing an MLME-REASSOCIATE.response primitive with a ResultCode indicating the security policy mismatch.

e) Otherwise, if the state for the STA is State 4, the STA has a valid security association, the STA has negotiated management frame protection, the reassociation is not a part of a fast BSS transition, the STA has not performed a successful SAE authentication after the current association was established, and there has been no earlier, timed out SA Query procedure with the STA (which would have allowed a new reassociation process to be started, without an additional SA Query procedure):

1) The SME shall refuse the reassociation request by issuing an MLME-REASSOCIATE.response primitive with ResultCode REFUSED\_TEMPORARILY and TimeoutInterval containing a Timeout Interval element with the Timeout Interval Type field set to 3 (Association Comeback time). If the SME is in an ongoing SA Query with the STA, the Timeout Interval Value field shall be set to the remaining SA Query period, otherwise it shall be set to dot11AssociationSAQueryMaximumTimeout.

2) The state for the STA shall be left unchanged.

3) Following this, if the SME is not in an ongoing SA Query with the STA, the SME shall issue one MLME-SA-QUERY.request primitive addressed to the STA every dot11AssociationSAQueryRetryTimeout TUs until an MLME-SA-QUERY.confirm primitive for the STA is received or dot11AssociationSAQueryMaximumTimeout TUs from the beginning of the SA Query procedure have passed. The SME shall increment the TransactionIdentifier by 1 for each MLME-SA-QUERY.request primitive, rolling it over to 0 after the maximum allowed value is reached.

4) If no MLME-SA-QUERY.confirm primitive for a STA is received within the dot11AssociationSAQueryMaximumTimeout period, the SME shall allow a subsequent reassociation process to be started without starting an additional SA Query procedure, except that the SME may deny a subsequent reassociation process with the STA if an MSDU was received from the STA within this period.

NOTE 1—Reception of an MSDU implies reception of a valid protected frame, which obviates the need for the SA Query procedure.

f) The SME shall refuse a reassociation request from a STA that does not support all the rates in the BSSBasicRateSet parameter and all of the membership selectors in the BSSMembershipSelectorSet parameter in the MLME-START.request primitive.

g) The SME shall refuse a reassociation request from an HT STA that does not support all of the MCSs in the Basic HT-MCS Set field of the HT Operation parameter in the MLME-START.request primitive.

h) The SME shall refuse a reassociation request from a VHT STA that does not support all of the <VHT-MCS, NSS> tuples indicated by the Basic VHT-MCS And NSS Set field of the VHT Operation parameter in the MLME-START.request primitive.

i) The SME shall refuse a reassociation request from an HE STA that does not support all of the <HE-MCS, NSS> tuples indicated by the Basic HE-MCS And NSS Set field of the HE Operation parameter in the MLME-START.request primitive.

j) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS, the SME has an existing SA with the STA, and an SA Query procedure with that STA has failed to receive a valid response (i.e., has not received an MLME-SA-QUERY.confirm primitive within the dot11AssociationSAQueryMaximumTimeout period), the SME shall issue an MLME-DISASSOCIATE.request primitive addressed to the STA with ReasonCode INVALID\_AUTHENTICATION.

NOTE 2—This MLME-DISASSOCIATE.request primitive generates a protected Disassociation frame. If the reassociation request was genuine, the STA has deleted the PTKSA by this point and so the protected Disassociation frame is ignored. The purpose is to inform a STA which has for some reason failed to respond to an SA Query procedure triggered by a forged reassociation request.

k) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS and the reassociation is not part of a fast BSS transition, the SME shall delete any PTKSA, GTKSA, IGTKSA, BIGTKSA, WIGTKSA, and TPKSA (including temporal keys) held for communication with the STA by using the MLME-DELETEKEYS.request primitive (see 12.6.18 (RSNA security association termination)).

l) If the MLME-REASSOCIATE.indication primitive includes an MMS parameter, the AP or PCP shall take the following additional action, as appropriate:

1) If the Single AID field in the MMS parameter of the MLME-REASSOCIATE.indication primitive is equal to 1, the AP or PCP may allocate a single AID for all of the STAs included in the MMS element. If the AP or PCP allocates the same AID to all STAs whose MAC address was included in the MMS element, it shall include the MMS element received from the MM-SME coordinated STA in the MLME-REASSOCIATE.response primitive.

2) If the Single AID field is 0, the AP or PCP shall allocate a distinct AID for each STA specified in the MMS element.

NOTE 3—When the Single AID field is 0, a separate reassociation request/response exchange is performed for each STA specified in the MMS element, and this assigns the multiple AIDs for the STAs.

m) If a Reassociation Response frame with a status code of SUCCESS is acknowledged by the STA, the state for the STA shall be set to State 4, or to State 3 if dot11RSNAActivated is true and the reassociation is not part of a fast BSS transition.

n) If the ResultCode in the MLME-REASSOCIATE.response primitive is not SUCCESS and management frame protection is in use the state for the STA shall be left unchanged. If the ResultCode is not SUCCESS, management frame protection is not in use, and the reassociation is part of a fast BSS transition, the state for the STA shall be left unchanged. If the ResultCode is not SUCCESS, management frame protection is not in use, and the reassociation is not part of a fast BSS transition, the state for the STA shall be set to State 3 if it was State 4.

NOTE—This means the STA remains associated but loses any security association in case of failure of reassociation to the same AP.

o) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS, RSNA establishment is required, and the reassociation is not part of a fast BSS transition, and FILS is not in use, the SME shall attempt a 4-way handshake. Upon a successful completion of a 4-way handshake, the SME shall enable protection by issuing an MLME-SETPROTECTION.request(Rx\_Tx) primitive. If FILS authentication was used, the SME shall enable protection by generating an MLME-SETPROTECTION.request(Rx\_Tx) primitive. In either case, upon receipt of the MLME-SETPROTECTION.request(Rx\_Tx) primitive, the MLME shall set the state for the STA to State 4.

p) AP only: The SME shall inform the DS of any changes in the state of the STA.

q) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS and the CurrentAPAddress parameter in the MLME-REASSOCIATION.indication primitive is this AP’s or PCP’s MAC address (reassociation to the same AP or PCP), the AP or PCP shall match the non-AP STA’s treatment of the listed agreements and allocations as described in 11.3.5.4 (Non-AP and non-PCP STA reassociation initiation procedures) item c). The AP or PCP deletes or resets to initial values those items that the non-AP STA is required in 11.3.5.4 (Non-AP and non-PCP STA reassociation initiation procedures) item c) to delete or reset to initial values, and the AP or PCP does not modify the states, agreements and allocations that are listed as not affected by the reassociation procedure.

r) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS and the CurrentAPAddress parameter in the MLME-REASSOCIATION.indication primitive is not this AP’s or PCP’s MAC address (reassociation to a different AP or PCP), all the states, agreements and allocations pertaining to the associating STA and listed in both numbered lists in 11.3.5.4 (Non-AP and non-PCP STA reassociation initiation procedures) item c) are deleted or reset to initial values.

**The proposed changes for CID 1699 - START**

The changes proposed in the comment on top of the REVme/D1.2 text

**11.3.5.4 Non-AP and non-PCP STA reassociation initiation procedures**

Except when the association is part of a fast BSS transition, the SME shall delete any PTKSA, GTKSA, IGTKSA, BIGTKSA, WIGTKSA, and TPKSA (including temporal keys) held for communication with the AP or PCP by using the MLME-DELETEKEYS.request primitive (see 12.6.18 (RSNA security association termination)) before invoking an MLME-REASSOCIATE.request primitive.

If dot11InterworkingServiceActivated is true and the STA was associated to the ESS for unsecured access to emergency services, the SME shall submit the MLME-REASSOCIATE.request primitive with EmergencyServices parameter set to true.

The MM-SME of a non-AP and non-PCP STA may include an MMS element in an MLME-REASSOCIATE.request primitive. The MM-SME shall include in the MMS element the MAC address associated with the MLME SAP instance to which the primitive is submitted.

Upon receipt of an MLME-REASSOCIATE.request primitive that is part of an on-channel tunneling (see 11.31.5 (On-channel Tunneling (OCT) operation)), a non-AP and non-PCP STA shall follow the rules in 11.31.5 (On-channel Tunneling (OCT) operation) in addition to the reassociation procedures described below.

Upon receipt of an MLME-REASSOCIATE.request primitive, a non-AP and non-PCP STA shall reassociate with an AP or PCP using the following procedure:

a) If the STA is not associated in the same ESS or the state for the new AP or PCP is State 1, the MLME shall inform the SME of the failure of the reassociation by issuing an MLME-REASSOCIATE.confirm primitive, and this procedure ends.

b) The MLME shall transmit a Reassociation Request frame to the new AP or PCP. The RSNE contained in the MLME-ASSOCIATE.request primitive shall be included in the Reassociation Request frame. The RSNE shall specify exactly one pairwise cipher suite and exactly one AKM suite. If the MLME-REASSOCIATE.request primitive contained the EmergencyServices parameter equal to true, an Interworking element with the UESA field set to 1 shall be included in the Reassociation Request frame.

c) If a Reassociation Response frame is received with a status code of SUCCESS, the state variable for the new AP or PCP shall be set to State 4 or to State 3 if dot11RSNAActivated is true and the FT protocol is not used with respect to the new AP or PCP and, unless the old AP or PCP and new AP or PCP are the same, to State 2 with respect to the old AP or PCP, and the MLME shall issue an MLME-REASSOCIATE.confirm primitive to inform the SME of the successful completion of the reassociation.

If the MLME-REASSOCIATION.request primitive has the new AP’s or PCP’s MAC address in the CurrentAPAddress parameter (reassociation to the same AP or PCP), the following states, agreements, and allocations shall be deleted or reset to initial values:

1) All EDCAF state

2) Any block ack agreements that are not GCR agreements

3) Sequence number

4) Packet number

5) Duplicate detection caches

6) Anything queued for transmission

7) Fragmentation and reassembly buffers

8) Power management mode

9) WNM sleep mode

10) TPKSAs established with any peers

11) TSPECs

12) DMG TSPECs

13) GLK-GCR agreement

14) MSCS

15) SCS

If the reassociation is to the same AP (as described above), the following states, agreements, and allocations are not affected by the reassociation procedure:

1) PSMP sessions

2) Enablement/Deenablement

3) GDD enablement

4) TDLS agreements

5) MMSLs

6) GCR agreements that are not GLK-GCR agreements

7) DMS agreements

8) TFS agreements

9) FMS agreements

10) Triggered autonomous reporting agreements

11) FTM sessions

12) DMG SP and CBAP allocations

13) PTP TSPECs

In the case of reassociation to a different AP or PCP (the CurrentAPAddress parameter is not the new AP’s or PCP’s MAC address), all the states, agreements and allocations listed above are deleted or reset to initial values.

d) If a Reassociation Response frame is received with a status code of SUCCESS, a DMG STA shall write to each of the following MIB attributes the corresponding subfield of the DMG BSS Parameter Configuration field of the DMG Operation element received from the AP or PCP to which it requested reassociation:

1) dot11PSRequestSuspensionInterval from the PSRequestSuspensionInterval subfield

2) dot11MinBHIDuration from the MinBHIDuration subfield

3) dot11BroadcastSTAInfoDuration from the BroadcastSTAInfoDuration subfield

4) dot11AssocRespConfirmTime from the AssocRespConfirmTime subfield

5) dot11MinPPDuration from the MinPPDuration subfield

6) dot11SPIdleTimeout from the SPIdleTimeout subfield

7) dot11MaxLostBeacons from the MaxLostBeacons subfield

e) If an Association Response frame is received with a status code of SUCCESS at an MM-SME coordinated STA and the Single AID field within the MMS element is equal to 1, then

— For each of its MAC entities advertised within the MMS element and for which dot11RSNAActivated is true, the state is set to State 3. Progress from State 3 to State 4 occurs independently in each such MAC entity.

— For each of its MAC entities advertised within the MMS element and for which dot11RSNAActivated is false, the state is set to State 4.

— For each of its MAC entities advertised within the MMS element the state for any other AP or PCP which is State 3 or State 4 prior to the association request shall be set to State 2.

f) If a Reassociation Response frame is received with a status code other than SUCCESS or the reassociation fails to complete within dot11AssociationResponseTimeout:

1) Except when the association is part of a fast BSS transition, the state for the AP or PCP shall be set to State 2 with respect to the new AP or PCP.

NOTE—This means the STA is disassociated in case of failure of reassociation to the same AP.

2) The MLME shall issue an MLME-REASSOCIATE.confirm primitive to inform the SME of the failure of the reassociation. The ResultCode returned in the MLME-REASSOCIATE.confirm primitive indicates the cause of the failed reassociation attempt. Any misconfiguration or parameter mismatch, e.g., data rates required as basic rates that the STA did not indicate as supported in the STA’s Supported Rates and BSS Membership Selectors element, shall be corrected before the SME issues an MLME-REASSOCIATE.request primitive for the same AP or PCP. If the status code indicates the reassociation failed because of a reason that is not related to configuration (e.g., the AP or PCP is unable to support additional associations) and the Reassociation Response frame does not include a Timeout Interval element with Timeout Interval Type equal to 3 the SME shall not issue an MLME-REASSOCIATE.request primitive for the same AP or PCP until a period of at least 2 s has elapsed. If the status code indicates the reassociation failed and the Reassociation Response frame contains a Timeout Interval element with Timeout Interval Type equal to 3, the SME shall not issue an MLME-REASSOCIATE.request primitive for the same AP or PCP until the period specified in the Timeout Interval element has elapsed.

g) If an MLME-REASSOCIATE.confirm primitive is received with a ResultCode of SUCCESS, and RSNA is required, and FILS authentication was not used, and the STA is in State 3, then the SME shall perform a 4-way handshake to establish an RSNA. As a part of a successful 4-way handshake, the SME shall enable protection by generating an MLME-SETPROTECTION.request(Rx\_Tx) primitive. If an MLME-REASSOCIATE.confirm primitive is received with a ResultCode of SUCCESS, and FILS authentication was used, and the STA is in State 3, then the SME shall enable protection by generating an MLME-SETPROTECTION.request(Rx\_Tx) primitive.

h) Upon receipt of the MLME-SETPROTECTION.request(Rx\_Tx) primitive, the MLME shall set the state of the STA to State 4.

**11.3.5.5 AP or PCP reassociation receipt procedures**

Upon receipt of a Reassociation Request frame from a STA the AP or PCP shall use the following procedure:

a) The MLME shall issue an MLME-REASSOCIATE.indication primitive to inform the SME of the reassociation request. The SME shall issue an MLME-REASSOCIATE.response primitive addressed to the STA identified by the PeerSTAAddress parameter of the MLME-REASSOCIATE.indication primitive. If the reassociation is not successful, the SME shall indicate a specific reason for the failure to reassociate in the ResultCode parameter. Upon receipt of the MLME-REASSOCIATE.response primitive, the MLME shall transmit a Reassociation Response frame.

b) If the state for the STA is State 1 and the STA is a non-DMG STA, the SME shall refuse the reassociation request by issuing an MLME-REASSOCIATE.response primitive with ResultCode NOT\_AUTHENTICATED.

c) AP with dot11InterworkingServiceActivated true only: If the MLME-REASSOCIATE.indication primitive has the EmergencyServices parameter set to true and the RSN parameter does not include an RSNE, the SME shall not reject the reassociation request on the basis that dot11RSNAActivated is true and dot11PrivacyInvoked is true thereby granting access, using unprotected frames (see 9.2.4.1.9 (Protected Frame subfield)), to the network for emergency services purposes.

d) Otherwise, in an RSNA the SME shall check the values received in the RSN parameter to see whether the values received match the security policy. If they do not, SME shall refuse the reassociation by issuing an MLME-REASSOCIATE.response primitive with a ResultCode indicating the security policy mismatch.

e) Otherwise, if the state for the STA is State 4, the STA has a valid security association, the STA has negotiated management frame protection, the reassociation is not a part of a fast BSS transition, the STA has not performed a successful SAE authentication after the current association was established, and there has been no earlier, timed out SA Query procedure with the STA (which would have allowed a new reassociation process to be started, without an additional SA Query procedure):

1) The SME shall refuse the reassociation request by issuing an MLME-REASSOCIATE.response primitive with ResultCode REFUSED\_TEMPORARILY and TimeoutInterval containing a Timeout Interval element with the Timeout Interval Type field set to 3 (Association Comeback time). If the SME is in an ongoing SA Query with the STA, the Timeout Interval Value field shall be set to the remaining SA Query period, otherwise it shall be set to dot11AssociationSAQueryMaximumTimeout.

2) The state for the STA shall be left unchanged.

3) Following this, if the SME is not in an ongoing SA Query with the STA, the SME shall issue one MLME-SA-QUERY.request primitive addressed to the STA every dot11AssociationSAQueryRetryTimeout TUs until an MLME-SA-QUERY.confirm primitive for the STA is received or dot11AssociationSAQueryMaximumTimeout TUs from the beginning of the SA Query procedure have passed. The SME shall increment the TransactionIdentifier by 1 for each MLME-SA-QUERY.request primitive, rolling it over to 0 after the maximum allowed value is reached.

4) If no MLME-SA-QUERY.confirm primitive for a STA is received within the dot11AssociationSAQueryMaximumTimeout period, the SME shall allow a subsequent reassociation process to be started without starting an additional SA Query procedure, except that the SME may deny a subsequent reassociation process with the STA if an MSDU was received from the STA within this period.

NOTE 1—Reception of an MSDU implies reception of a valid protected frame, which obviates the need for the SA Query procedure.

f) The SME shall refuse a reassociation request from a STA that does not support all the rates in the BSSBasicRateSet parameter and all of the membership selectors in the BSSMembershipSelectorSet parameter in the MLME-START.request primitive.

g) The SME shall refuse a reassociation request from an HT STA that does not support all of the MCSs in the Basic HT-MCS Set field of the HT Operation parameter in the MLME-START.request primitive.

h) The SME shall refuse a reassociation request from a VHT STA that does not support all of the <VHT-MCS, NSS> tuples indicated by the Basic VHT-MCS And NSS Set field of the VHT Operation parameter in the MLME-START.request primitive.

i) The SME shall refuse a reassociation request from an HE STA that does not support all of the <HE-MCS, NSS> tuples indicated by the Basic HE-MCS And NSS Set field of the HE Operation parameter in the MLME-START.request primitive.

j) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS, the SME has an existing SA with the STA, and an SA Query procedure with that STA has failed to receive a valid response (i.e., has not received an MLME-SA-QUERY.confirm primitive within the dot11AssociationSAQueryMaximumTimeout period), the SME shall issue an MLME-DISASSOCIATE.request primitive addressed to the STA with ReasonCode INVALID\_AUTHENTICATION.

NOTE 2—This MLME-DISASSOCIATE.request primitive generates a protected Disassociation frame. If the reassociation request was genuine, the STA has deleted the PTKSA by this point and so the protected Disassociation frame is ignored. The purpose is to inform a STA which has for some reason failed to respond to an SA Query procedure triggered by a forged reassociation request.

k) If management frame protection is not in use, or the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS and the reassociation is not part of a fast BSS transition, the SME shall delete any PTKSA, GTKSA, IGTKSA, BIGTKSA, WIGTKSA, and TPKSA (including temporal keys) held for communication with the STA by using the MLME-DELETEKEYS.request primitive (see 12.6.18 (RSNA security association termination)).

l) If the MLME-REASSOCIATE.indication primitive includes an MMS parameter, the AP or PCP shall take the following additional action, as appropriate:

1) If the Single AID field in the MMS parameter of the MLME-REASSOCIATE.indication primitive is equal to 1, the AP or PCP may allocate a single AID for all of the STAs included in the MMS element. If the AP or PCP allocates the same AID to all STAs whose MAC address was included in the MMS element, it shall include the MMS element received from the MM-SME coordinated STA in the MLME-REASSOCIATE.response primitive.

2) If the Single AID field is 0, the AP or PCP shall allocate a distinct AID for each STA specified in the MMS element.

NOTE 3—When the Single AID field is 0, a separate reassociation request/response exchange is performed for each STA specified in the MMS element, and this assigns the multiple AIDs for the STAs.

m) If a Reassociation Response frame with a status code of SUCCESS is acknowledged by the STA, the state for the STA shall be set to State 4, or to State 3 if dot11RSNAActivated is true and the reassociation is not part of a fast BSS transition.

n) If the ResultCode in the MLME-REASSOCIATE.response primitive is not SUCCESS and management frame protection is in use the state for the STA shall be left unchanged. If the ResultCode is not SUCCESS, management frame protection is not in use, and the reassociation is part of a fast BSS transition, the state for the STA shall be left unchanged. If the ResultCode is not SUCCESS, management frame protection is not in use, the reassociation is not part of a fast BSS transition, and the state for the STA was State 3 or State 4, the state for the STA shall be set to State 2 if the reassociation is for the same AP, or to State 3 otherwise.o) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS, RSNA establishment is required, and the reassociation is not part of a fast BSS transition, and FILS is not in use, the SME shall attempt a 4-way handshake. Upon a successful completion of a 4-way handshake, the SME shall enable protection by issuing an MLME-SETPROTECTION.request(Rx\_Tx) primitive. If FILS authentication was used, the SME shall enable protection by generating an MLME-SETPROTECTION.request(Rx\_Tx) primitive. In either case, upon receipt of the MLME-SETPROTECTION.request(Rx\_Tx) primitive, the MLME shall set the state for the STA to State 4.

p) AP only: The SME shall inform the DS of any changes in the state of the STA.

q) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS and the CurrentAPAddress parameter in the MLME-REASSOCIATION.indication primitive is this AP’s or PCP’s MAC address (reassociation to the same AP or PCP), the AP or PCP shall match the non-AP STA’s treatment of the listed agreements and allocations as described in 11.3.5.4 (Non-AP and non-PCP STA reassociation initiation procedures) item c). The AP or PCP deletes or resets to initial values those items that the non-AP STA is required in 11.3.5.4 (Non-AP and non-PCP STA reassociation initiation procedures) item c) to delete or reset to initial values, and the AP or PCP does not modify the states, agreements and allocations that are listed as not affected by the reassociation procedure.

r) If the ResultCode in the MLME-REASSOCIATE.response primitive is SUCCESS and the CurrentAPAddress parameter in the MLME-REASSOCIATION.indication primitive is not this AP’s or PCP’s MAC address (reassociation to a different AP or PCP), all the states, agreements and allocations pertaining to the associating STA and listed in both numbered lists in 11.3.5.4 (Non-AP and non-PCP STA reassociation initiation procedures) item c) are deleted or reset to initial values.

**The proposed changes for CID 1699 - END**

**Proposed comment resolution for CID 1699 – option A**

REVISED. Make the changes proposed in the comment in 11.3.5.4. Do not change 11.3.5.5 since the SAs are not dropped on the AP in this case and even the State remains unchanged if management frame protection is used.

**Proposed comment resolution for CID 1699 – option B**

REVISED. Make the changes marked as "The proposed changes for CID 1699" in <this document>. This adds a NOTE for the non-AP STA and modifies 11.3.5.5 to match AP behavior to delete the SAs in 12.6.18, i.e., to delete them in this particular case of failing reassociation to the same AP when management frame protection is not used. Furthermore, the AP will go to State 2 instead State 3 in this specific case.

## CID 1813

**Owning Adhoc**: MAC

**Location**: 11.12

**Comment**

It is not clear whether, under MFP, BIP is used for all broadcast Management frames, or only robust broadcast Management frames (robust Management frames being defined in 12.2.7 as "Disassociation, Deauthentication, and robust Action frames.") E.g. the following suggest they apply to all broadcast Management frames, not just robust ones:  
  
"Management frame protection protocols in an infrastructure BSS or IBSS apply to robust Management frames after RSNA PTK establishment for protection of individually addressed frames is completed and after delivery of the IGTK to protect group addressed frames."  
  
"For all other group addressed Management frames [...]  
-- The frames shall be encapsulated and protected using BIP (see 12.5.4 (Broadcast/multicast integrity protocol (BIP)))."

**Proposed Change**

In 4.5.4.9 change

"Management frame protection protocols in an infrastructure BSS or IBSS apply to robust Management frames after RSNA PTK establishment for protection of individually addressed frames is completed and  
after delivery of the IGTK to protect group addressed frames. Beacon frames are protected in an  
infrastructure BSS after delivery of the BIGTK."

to

"Management frame protection protocols in an infrastructure BSS or IBSS apply to robust Management  
frames: after delivery of the PTK to protect individually addressed frames and after delivery of the IGTK to protect group addressed frames. Beacon frames are protected in an infrastructure BSS after delivery of the BIGTK.".

In 11.12 change

"For all other group addressed Management frames, the group addressed frame protection service shall take the following actions:"

to

"For all other group addressed robust Management frames, the group addressed frame protection service shall take the following actions:"

**Discussion**

This comment was discussed 2022-01-2119:03:51Z:

* + 1. CID 1813 (MAC)
       1. Review Comment
       2. Review context.
       3. Discussion on the reason for the need for the change.
       4. Discussion on if “robust” should be added or not.
       5. This is in Clause 4, so the existing text may have an error in it that needs to be reviewed outside the context of this CID, but if we are making changes in the clause, then maybe we should fix the “after deliver of the IGTK” phrase. To “after deliver of the BIGTK”
       6. Assign the comment to Jouni to complete the clean-up of the clause.

The identified additional issue with the current text is in the concept of protection of group addressed frames applying only when the applicable key has been delivered. However, the management frame protection protocol applies on the transmitter (e.g., an AP in the case of infrastructure BSS) all the time independent of IGTK/BIGTK delivery while the "after delivery" part is applicable on the receivers of these group addressed frames.

The changes proposed in the comment on top of the REVme/D1.2 text

**4.5.4.9 Management frame protection**

Robust Management frames are a set of Management frames that can be protected by the management frame protection service.

Management frame protection protocols in an infrastructure BSS or IBSS apply to robust Management frames: after delivery of the PTK to protect individually addressed frames and after delivery of the IGTK to protect group addressed frames. Beacon frames are protected in an infrastructure BSS after delivery of the BIGTK.

Management frame protection protocols in an MBSS apply to the following frames:

— Individually addressed robust Management frames after establishment of the RSNA MTK,

— Group addressed robust Management frames that are specified with Yes in the “Group Addressed Privacy” column of Table 9-79 (Category values) after establishment of the MGTK, and

— Group addressed robust Management frames that are specified with No in the “Group Addressed Privacy” column of Table 9-79 (Category values) after establishment of the IGTK.

See 14.7 (Mesh security) for details.

Management frame protection is implemented by CCMP, GCMP, and BIP confidentiality protocols and the SA Query procedure.

**11.12 Group addressed management frame protection procedures**

When management frame protection is negotiated, the MLME shall provide an encapsulation service for group addressed robust Management frames. All group addressed robust Management frames shall be submitted to this service for encapsulation and transmission.

In an MBSS, for group addressed Management frames that are specified with Yes in the Group Addressed Privacy column of Table 9-79 (Category values), the group addressed frame protection service shall take the following actions:

— The frames shall be encapsulated and protected with the MGTK using the group cipher negotiated during the AMPE exchange.

For all other group addressed robust Management frames, the group addressed frame protection service shall take the following actions:

— Management frame protection for multicast/broadcast shall be set using the MLMESETPROTECTION.request primitive with the Protectlist including a Key Type value of IGTK. A non-AP STA shall also set the Protect Type value to Rx. In an IBSS, a STA shall set the ProtectType value to Rx\_Tx. An AP shall set the Protect Type value to Tx.

— The IGTK shall be installed using the MLME-SETKEYS.request primitive with the value IGTK for the Key Type parameter of the SetKeyDescriptor.

— The frames shall be encapsulated and protected using BIP (see 12.5.3 (Broadcast/multicast integrity protocol (BIP))).

**The proposed changes for CID 1813 - START**

*Change 4.5.4.9 as shown (based on REVme/D1.2):*

**4.5.4.9 Management frame protection**

Robust Management frames are a set of Management frames that can be protected by the management frame protection service.

Management frame protection protocols in an infrastructure BSS or IBSS apply to transmission and reception of individually addressed robust Management frames after delivery of the PTK, transmission of group addressed robust Management frames, reception of group addressed robust Management frames after delivery of the IGTK, transmission of Beacon frames in an infrastructure BSS, and reception of Beacon frames in an infrastructure BSS after delivery of the BIGTK.

Management frame protection protocols in an MBSS apply to the following frames:

— Individually addressed robust Management frames after establishment of the RSNA MTK,

— Group addressed robust Management frames that are specified with Yes in the “Group Addressed Privacy” column of Table 9-79 (Category values) after establishment of the MGTK, and

— Group addressed robust Management frames that are specified with No in the “Group Addressed Privacy” column of Table 9-79 (Category values) after establishment of the IGTK.

See 14.7 (Mesh security) for details.

Management frame protection is implemented by CCMP, GCMP, and BIP confidentiality protocols and the SA Query procedure.

*Change 11.12 as shown (based on REVme/D1.2):*

**11.12 Group addressed management frame protection procedures**

When management frame protection is negotiated, the MLME shall provide an encapsulation service for group addressed robust Management frames. All group addressed robust Management frames shall be submitted to this service for encapsulation and transmission.

In an MBSS, for group addressed Management frames that are specified with Yes in the Group Addressed Privacy column of Table 9-79 (Category values), the group addressed frame protection service shall take the following actions:

— The frames shall be encapsulated and protected with the MGTK using the group cipher negotiated during the AMPE exchange.

For all other group addressed robust Management frames, the group addressed frame protection service shall take the following actions:

— Management frame protection for multicast/broadcast shall be set using the MLMESETPROTECTION.request primitive with the Protectlist including a Key Type value of IGTK. A non-AP STA shall also set the Protect Type value to Rx. In an IBSS, a STA shall set the ProtectType value to Rx\_Tx. An AP shall set the Protect Type value to Tx.

— The IGTK shall be installed using the MLME-SETKEYS.request primitive with the value IGTK for the Key Type parameter of the SetKeyDescriptor.

— The frames shall be encapsulated and protected using BIP (see 12.5.3 (Broadcast/multicast integrity protocol (BIP))).

**The proposed changes for CID 1813 - END**

**Proposed comment resolution for CID 1813**

REVISED. Make the changes marked as "The proposed changes for CID 1813" in <this document>. This includes the changes proposed in the comment and additional changes to 4.5.4.9 to clean up the description of management frame protection protocol applicability to group addressed frames.