IEEE P802.11
Wireless LANs

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| Resolutions for some comments on 11me/D2.0 (LB270) |
| Date: 2022-12-16 |
| Author(s): |
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| Mark RISON | Samsung Cambridge Solution Centre | SJH, CB4 0DS, U.K. | +44 1223 434600 | at samsung (a global commercial entity) I'm the letter emme then dot rison |

Abstract

This submission proposes resolutions for various CIDs on 11me/D2.0. Green indicates material agreed to in the group, yellow material to be discussed, red material rejected by the group and cyan material not to be overlooked. The “Final”/“No Markup” view should be selected in Word (this means Word comments can be disregarded by the Editor).

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3510Mark RISON9.4.2.17 | The Supported Channels element stuff is a mess.Some bits of the spec suggest this element only applies to DFS operation(e.g. Clause 6), others that that it doesn't apply if you support ECSA(e.g. Clause 9). 9.2.4.17 even suggests it only applies to 11a!But 9.6.7.16/12.2/12.3 indicates it's also used for TDLS. 11.8.2/8suggest it's about letting the AP decide whether to allow a STA toassociate, based on the channels it supports, and if so what channelsto use when changing channels. 11.20.6 says that for TDLS you includeboth that a Supported Operating Classes element, but it doesn't describehow you determine which OC in the SOCe a given channel in the SCeapplies to | At the start of the referenced subclause add "The Supported Channels element means completely different things in different contexts." |

Discussion:

Here are the key instances of “Supported Channels”:

**4.5.5.3 DFS**

[…]

The DFS service provides for the following:

— Association of STAs with an AP based on the STAs’ supported channels.

**4.5.8 Radio measurement service**

The Radio measurement service provides the following:

— The ability to request and report radio measurements in supported channels.

— The ability to perform radio measurements in supported channels.

**6.5.7.2.2 Semantics of the service primitive [ditto reassoc]**

The primitive parameters are as follows:

MLME-ASSOCIATE.request(

[…]

Supported Channels

The list of channels in which the STA is capable of operating.

Present if DFS functionality is required, as specified in 11.8 (DFS procedures); otherwise not present.

=> DFS-only

**Table 9-62—Association Request frame body [ditto reassoc]**

The Supported Channels element is present if dot11SpectrumManagementRequired is true and dot11ExtendedChannelSwitchActivated is false.

=> suggests not present if ECSA supported; at least not required

**9.4.2.17 Supported Channels element**

The Supported Channels element contains a list of channel subbands (from those channels defined in 17.3.8.4.3 (Channelization)) in which a STA is capable of operating.

=> 11a-only

[…]

The use of the Supported Channels element is described in 11.8.2 (Association based on supported channels) and 11.8.8 (Selecting and advertising a new channel).

=> about letting the AP decide whether to allow a STA to associate based on the channels it supports, and what channel to switch to

**9.4.2.20.7 Beacon request**

[…]

For operating classes that identify the location of the primary channel, a Channel Number field set to 0 indicates a request to make iterative measurements for all supported channels in the operating class where the measurement is permitted on the channel and the channel is valid for the current regulatory domain.

For operating classes that encompass a primary channel but do not identify the location of the primary channel, a Channel Number field set to 0 indicates a request to make iterative measurements for all primary channel positions within all requested and supported channels where the measurement is permitted on the channel and the channel is valid for the current regulatory domain.

For operating classes that identify the location of the primary channel, a Channel Number field set to 255 indicates a request to make iterative measurements for all supported channels in the current operating class listed in the latest AP Channel Report received from the serving AP.

**Table 9-457—TDLS Discovery Response frame Action field format [ditto setup req]**

 […]

The Supported Channels element is present if the TDLS Channel Switching subfield is equal to 1.

The Supported Channels element is defined in 9.4.2.17 (Supported Channels element).

=> also used for TDLS

**Table 9-498—Information for TDLS Setup Response Action field**

[…]

The Supported Channels element is defined in 9.4.2.17 (Supported Channels element). It is present if the TDLS Channel Switching subfield is equal to 1 and the Status Code is SUCCESS, and not present otherwise.

=> also used for TDLS

**Table 9-519—Mesh Peering Open frame Action field format**

[…]

The Supported Channels element is present if dot11SpectrumManagementRequired is true and dot11ExtendedChannelSwitchActivated is false.

=> suggests not present if ECSA supported; at least not required

**10.39.12.2.1 Channel access rules**

[…]

An EDMG STA shall not transmit an EDMG PPDU to a peer EDMG STA over a channel that is not supported by the peer STA as indicated in the Supported Channels field [I think subelement is intended here] in the peer STA’s EDMG Capabilities element.

**11.8 DFS procedures**

**11.8.1 General [ditto DMG]**

[…]

Attribute dot11SpectrumManagementRequired shall be set to true (#1038)if regulatory authorities require DFS. It may also be set to true in other circumstances. The DFS procedures provide for the following:

— Associating STAs with an AP based on the STAs’ supported channels (see 11.8.2 (Association based on supported channels)).

=> about letting the AP decide whether to allow a STA to associate based on the channels it supports

**11.8.2.1 Association based on supported channels in a non-DMG BSS [similar DMG]**

A STA shall provide an AP with a list of the channels in which the STA can operate when associating or reassociating by including a Supported Channels element in its (Re)Association Request frames.

=> about letting the AP decide whether to allow a STA to associate based on the channels it supports

An AP may use the supported channels list for associated STAs as an input into an algorithm used to select a new channel for the BSS. The specification of this algorithm is beyond the scope of this standard.

=> about helping the AP choose which channel to switch to

**11.8.8.2 Selecting and advertising a new channel in a non-DMG infrastructure BSS [similar DMG]**

[…]

The decision to switch to a new operating channel in an infrastructure BSS shall be made only by the AP. An AP may make use of the information in Supported Channel [should be Channels, also in MBSS and DMG] elements and the results of measurements undertaken by the AP and other STAs in the BSS to assist the selection of the new channel. The algorithm to choose a new channel is beyond the scope of this standard. The AP shall attempt to select a new channel that is supported by all associated STAs.

=> about helping the AP choose which channel to switch to

**11.9.3.2 Selecting and advertising a new channel in an infrastructure BSS [similar MBSS]**

[…]

The decision to switch to a new operating channel and/or operating class in an infrastructure BSS is made by the AP when dot11DSERequired is false. An AP may make use of the information in the Supported Channels element, Supported Operating Classes element, and the results of measurements undertaken by the AP and other STAs in the BSS to assist the selection of the new channel and/or operating class.

=> about helping the AP choose which channel to switch to

**11.20.6.1 General**

The STA shall include a Supported Channels element and a Supported Operating Classes element in all TDLS Setup Request and TDLS Setup Response frames that have a TDLS Channel Switching subfield equal to 1. The STA shall include only channels in the Supported Channels element for which it can adhere to the local power constraint.

=> how do you determine which OC in the SOCe a given channel in the SCe applies to?

**B.4.10 Spectrum management extensions**

SM3 Power Capability and Supported Channels elements in (Re)Association Request and Response frames

CFSM:M

=> so not if spectrum management not supported

My starting suggestion would be:

* the bits that suggest it's 11a-only or DFS-only or SM-only are just wrong
* the bits that suggest it's not used if ECSA is supported are misleading
* the combined use of SC and SOC in TDLS needs clarification (or just delete the SOC from the TDLS frames?)
* the EDMG typo should be fixed
* the Supported Channel element typos should be fixed

Proposed changes:

Make the following changes:

**6.5.7.2.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-ASSOCIATE.request(

[…]

Supported Channels

The list of channels in which the STA is capable of operating.

Present if DFS functionality is required, as specified in 11.8 (DFS procedures); otherwise ~~not~~optionally present.

**6.5.8.2.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-REASSOCIATE.request(

[…]

Supported Channels

The list of channels in which the STA is capable of operating.

Present if DFS functionality is required, as specified in 11.8 (DFS procedures); otherwise ~~not~~optionally present.

**Table 9-62—Association Request frame body**

The Supported Channels element is present if dot11SpectrumManagementRequired is true and dot11ExtendedChannelSwitchActivated is false.

The Supported Channels element is optionally present, otherwise.

**Table 9-64—Reassociation Request frame body**

The Supported Channels element is present if dot11SpectrumManagementRequired is true and dot11ExtendedChannelSwitchActivated is false.

The Supported Channels element is optionally present, otherwise.

**9.4.2.17 Supported Channels element**

The Supported Channels element contains a list of channel subbands ~~(from those channels defined in 17.3.8.4.3 (Channelization))~~ in which a STA is capable of operating.

 […]

~~The use of the Supported Channels element is described in 11.8.2 (Association based on supported channels) and 11.8.8 (Selecting and advertising a new channel).~~

**Table 9-519—Mesh Peering Open frame Action field format**

The Supported Channels element is present if dot11SpectrumManagementRequired is true and dot11ExtendedChannelSwitchActivated is false.

The Supported Channels element is optionally present, otherwise.

**10.39.12.2.1 Channel access rules**

An EDMG STA shall not transmit an EDMG PPDU to a peer EDMG STA over a channel that is not supported by the peer STA as indicated in the Supported Channels ~~field~~subelement in the peer STA’s EDMG Capabilities element.

**11.8.8.2 Selecting and advertising a new channel in a non-DMG infrastructure BSS**

The decision to switch to a new operating channel in an infrastructure BSS shall be made only by the AP. An AP may make use of the information in Supported Channels elements and the results of measurements undertaken by the AP and other STAs in the BSS to assist the selection of the new channel.

**11.8.8.4.1 General**

A mesh STA may make use of the information in Supported Channels elements, Supported Operating Classes

elements, and the results of measurements undertaken by the mesh STAs in the MBSS to assist the selection of

the new channel.

**11.8.8.6 Selecting and advertising a new channel in a DMG BSS**

The decision to switch to a new operating channel in a DMG BSS shall be made only by an AP or PCP. An AP

or PCP may make use of the information in received Supported Channels elements and the results of

measurements undertaken by the AP or PCP and other STAs in the BSS to assist the selection of the new

channel.

**11.20.6.1 General**

The STA shall include a Supported Channels element and a Supported Operating Classes element in all TDLS Setup Request and TDLS Setup Response frames that have a TDLS Channel Switching subfield equal to 1. The Supported Channels element shall indicate the channels supported for the current operating class. The STA shall include only channels in the Supported Channels element for which it can adhere to the local power constraint.

**B.4.10 Spectrum management extensions**

SM3 Power Capability and Supported Channels elements in (Re)Association Request and Response frames

CFSM:M

NOT CFSM:O

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3510 in <this document>, which clarify the usage of the Supported Channels element.

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| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3338Mark RISON | Sometimes it's "The BSS Load element is optionally present ifdot11QosOptionImplemented and dot11QBSSLoadImplemented" and sometimes "is present". Also a DMG STA is a QoS STA | At 737.31 change "The BSS Load element is optionally present ifdot11QosOptionImplemented and dot11QBSSLoadImplemented areboth true; otherwise not present.(#1598-Ed1)" to "The BSS Load element is present ifdot11QBSSLoadImplemented is true; otherwise not present.(#1598-Ed1)" |

Discussion:

Solomon TRAININ has clarified that:

The general approach in the DMG is to have an alternative way to deliver elements. This element same like some others may be delivered in the Announce frame instead or in addition to the DMG beacon

[Note: it doesn’t in fact seem to be possible to deliver a BSS Load element in an Announce frame. Something for D3.0!]

So the element should remain optional in DMG beacons. But it’s mandatory in Probe Responses sent by a DMG AP (or indeed a PCP).

It is also the case that DMG APs are QoS STAs, so checking dot11QosOptionImplemented is otiose. Ditto for VHT APs.

Dave GOODALL has clarified that:

It is optional for S1G to support BSS Load. We would typically put the element in a Probe Response but it is optional to put it in an S1G Beacon.

So this is the same behaviour as for DMG.

Proposed changes:

Change at 697.25 (in Table 9-60—Beacon frame body) and 725.15 (in Table 9-67—Probe Response frame body):

The Extended BSS Load element is optionally present if

~~dot11QosOptionImplemented,~~ dot11QBSSLoadImplemented~~,~~ and

dot11VHTOptionImplemented are both true.

Change at 737.31 (in Table 9-73—DMG Beacon frame body):

The BSS Load element is optionally present if

~~dot11QosOptionImplemented and~~ dot11QBSSLoadImplemented ~~are~~

~~both~~is true; otherwise not present.

Change at 4903.3 (in C.3 MIB):

dot11QBSSLoadImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute is available only at a~~n~~ QoS AP or PCP. This attribute, when true, indicates that the AP or PCP ~~implementation is capable of generating and transmitting~~transmits the BSS ~~l~~Load element in ~~the~~ Beacon frames (non-DMG non-S1G AP only) and Probe Response frames, and optionally in DMG Beacon frames (DMG AP or PCP only) and S1G Beacon frames (S1G AP only); optionally transmits the Extended BSS Load element in Beacon and Probe Response frames (VHT AP only); and optionally transmits the HE BSS Load element in Beacon and Probe Response frames (HE AP only). These elements are not transmitted~~The capability is disabled~~, otherwise."

::= { dot11StationConfigEntry 36 }

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3338 in <this document>, which make changes in the suggested direction (including recognising VHT and DMG APs as necessarily QoS APs), but keep the BSS Load element optional in DMG beacons. The description of the dot11QBSSLoadImplemented attribute is aligned with Clause 9.

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| Identifiers | Comment | Proposed change |
| CID 3541Mark RISONC.3 | Can read-create MIB attributes have a DEFVAL? What does read-create mean anyway? | Delete DEFVAL lines for MIB attributes that are read-create |

Discussion:

Here are examples:

dot11PPEThresholdsMappingStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status column used for creating, modifying, and deleting instances of the columnar objects in the PPE thresholds mapping table."

DEFVAL { active }

::= { dot11PPEThresholdsMappingsEntry 6 }

dot11RMRqstDuration OBJECT-TYPE

SYNTAX Unsigned32

UNITS "TUs"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity when requesting a

measurement.

Changes take effect when dot11RMRqstRowStatus is set to Active.

This attribute indicates the preferred or mandatory measurement duration

for this Measurement Request. This attribute is ignored if dot11RMRqstType = LCI or Measurement Pause."

DEFVAL { 0 }

::= { dot11RMRequestEntry 12 }

RFC 2578 (Structure of Management Information Version 2 (SMIv2)) says:

 The MAX-ACCESS clause, which must be present, defines whether it

 makes "protocol sense" to read, write and/or create an instance of

 the object, or to include its value in a notification. This is the

 maximal level of access for the object. (This maximal level of

 access is independent of any administrative authorization policy.)

 The value "read-write" indicates that read and write access make

 "protocol sense", but create does not. The value "read-create"

 indicates that read, write and create access make "protocol sense".

 The value "not-accessible" indicates an auxiliary object (see Section

 7.7). The value "accessible-for-notify" indicates an object which is

 accessible only via a notification (e.g., snmpTrapOID [5]).

 These values are ordered, from least to greatest: "not-accessible",

 "accessible-for-notify", "read-only", "read-write", "read-create".

 If any columnar object in a conceptual row has "read-create" as its

 maximal level of access, then no other columnar object of the same

 conceptual row may have a maximal access of "read-write". (Note that

 "read-create" is a superset of "read-write".)

and:

 The DEFVAL clause, which need not be present, defines an acceptable

 default value which may be used at the discretion of an agent when an

 object instance is created. That is, the value is a "hint" to

 implementors.

 During conceptual row creation, if an instance of a columnar object

 is not present as one of the operands in the correspondent management

 protocol set operation, then the value of the DEFVAL clause, if

 present, indicates an acceptable default value that an agent might

 use (especially for a read-only object).

 Note that with this definition of the DEFVAL clause, it is

 appropriate to use it for any columnar object of a read-create table.

 It is also permitted to use it for scalar objects dynamically created

 by an agent, or for columnar objects of a read-write table

 dynamically created by an agent.

and:

 For newly-defined conceptual rows which allow the creation of new

 object instances and/or the deletion of existing object instances,

 there should be one columnar object with a SYNTAX clause value of

 RowStatus (a textual convention defined in [[3](https://www.rfc-editor.org/rfc/rfc2578.html#ref-3)]) and a MAX-ACCESS

 clause value of read-create. By convention, this is termed the

 status column for the conceptual row.

Proposed resolution:

REJECTED

RFC 2578 specifies that read-create means that “read, write and create access make "protocol sense"” (and requires that read-write not be used for a table if read-create is used). It also specifies that a DEFVAL can be used “for any columnar object of a read-create table”.

|  |  |  |
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| Identifiers | Comment | Proposed change |
| CID 3290Mark RISON | "ERP-DSSS modes" is not clear since ERP-DSSS is itself defined as a mode of a PHY. Ditto CCK and OFDM | Use better terminology |

Discussion:

Instances (note no instances of “ERP-CCK mode”):

18.1.3: For example, a BSS could operate in an ERP-OFDM-only mode, a mixed mode of ERP-OFDM and ERP-DSSS/CCK, or a mixed mode of ERP-DSSS/CCK and non-ERP. When options are enabled, combinations are also allowed. [Arguably is about the mode of the BSS]

18.3.2.4: The format, preamble, and headers for the ERP-OFDM PPDU are described in 17.3.2 (PPDU format) to 17.3.5 (DATA field). For the ERP-OFDM modes, the DATA field that contains the SERVICE field, the PSDU, the TAIL bits, and the PAD bits shall follow 17.3.5 (DATA field).

For ERP-OFDM modes, an ERP PPDU is (#14)immediately followed by a period of no transmission with a duration of aSignalExtension(#14)

18.4.7.3: The transmit spectral mask for the ERP-OFDM modes shall follow 17.3.9.3 (Transmit spectrum mask) and is shown in Figure 17-13 (Transmit spectrum mask for 20 MHz transmission) therein. The transmit spectral mask for the ERP-DSSS modes shall follow 16.3.7.4 (Transmit spectrum mask) and is shown in Figure 16-8 (Transmit spectrum mask) therein.

18.4.8.1: Subclause 18.4.8 (PHY receive specifications) describes the receive specifications for the PHY sublayer. The receive specification for the ERP-OFDM modes shall follow 17.3.10 (PHY receiver specifications) with the exception of the receiver maximum input level (17.3.10.5 (Receiver maximum input level)) and the adjacent channel rejection (17.3.10.3 (Adjacent channel rejection)). The receive specifications for the ERP-DSSS modes shall follow 16.3.8 (PHY receiver specifications) with the exception of the receiver maximum input level (16.3.8.3 (Receiver maximum input level)).

18.4.8.2: The PER of the ERP-OFDM modes shall be less than 10% at a PSDU length of 1000 octets for the input levels of Table 17-18 (Receiver performance requirements) of 17.3.10 (PHY receiver specifications). […] The PER for ERP-CCK shall be as specified in 16.3.8.2 (Receiver minimum input level sensitivity).

18.4.8.3: The adjacent channel rejection of the ERP-DSSS modes shall follow 16.3.8.4 (Receiver adjacent channel

rejection).

Proposed changes:

18.1.3: For example, a BSS could operate in an ERP-OFDM-only mode, a mixed mode of ERP-OFDM and ERP-DSSS/CCK, or a mixed mode of ERP-DSSS/CCK and non-ERP. When options are enabled, combinations are also allowed. *[No change]*

18.3.2.4: The format, preamble, and headers for the ERP-OFDM PPDU are described in 17.3.2 (PPDU format) to 17.3.5 (DATA field). For ERP-OFDM PPDUs, the DATA field that contains the SERVICE field, the PSDU, the TAIL bits, and the PAD bits shall follow 17.3.5 (DATA field).

An ERP-OFDM PPDU is (#14)immediately followed by a period of no transmission with a duration of aSignalExtension(#14)

18.4.7.3: The transmit spectral mask for ERP-OFDM PPDUs shall follow 17.3.9.3 (Transmit spectrum mask) and is shown in Figure 17-13 (Transmit spectrum mask for 20 MHz transmission) therein. The transmit spectral mask for ERP-DSSS PPDUs shall follow 16.3.7.4 (Transmit spectrum mask) and is shown in Figure 16-8 (Transmit spectrum mask) therein.

18.4.8.1: Subclause 18.4.8 (PHY receive specifications) describes the receive specifications for the PHY sublayer. The receive specification for ERP-OFDM PPDUs shall follow 17.3.10 (PHY receiver specifications) with the exception of the receiver maximum input level (17.3.10.5 (Receiver maximum input level)) and the adjacent channel rejection (17.3.10.3 (Adjacent channel rejection)). The receive specification for ERP-DSSS PPDUs shall follow 16.3.8 (PHY receiver specifications) with the exception of the receiver maximum input level (16.3.8.3 (Receiver maximum input level)).

18.4.8.2: The PER for ERP-OFDM PPDUs shall be less than 10% at a PSDU length of 1000 octets for the input levels of Table 17-18 (Receiver performance requirements) of 17.3.10 (PHY receiver specifications). […] The PER for ERP-CCK PPDUs shall be as specified in 16.3.8.2 (Receiver minimum input level sensitivity).

18.4.8.3: Adjacent channels at 2.4 GHz are defined to be at ± 25 MHz spacing. ***<para break>***

For ERP-OFDM PPDUs, the adjacent channel rejection shall be measured by setting the desired signal’s strength 3 dB above the rate-dependent sensitivity specified in Table 17-18 (Receiver performance requirements) of 17.3.10 (PHY receiver specifications) […]

The adjacent channel rejection for ERP-DSSS PPDUs shall follow 16.3.8.4 (Receiver adjacent channel

rejection).

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3290 in <this document>, which refer to ERP PPDUs rather than modes, and add flavours where missing.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3719Mark RISONC.3 | dot11RSNAConfigGroupRekeyPackets should be stated to apply only if dot11RSNAConfigGroupRekeyMethod is packetBased(3) or timepacketBased(4) | As it says in the comment |

Discussion:

We have:

dot11RSNAConfigGroupRekeyTime OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

UNITS "seconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

The time after which the (#1980)(#1509)GTK is (#1382)refreshed (by rekeying). The timer starts at the moment the GTK was set using the MLME-SETKEYS.request primitive."

DEFVAL { 86400 } -- once per day

::= { dot11RSNAConfigEntry 6 }

dot11RSNAConfigGroupRekeyPackets OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

UNITS "1000 packets"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

A packet count after which the (#1980)(#1509)GTK is (#1382)refreshed (by rekeying). The packet counter starts at the moment the GTK was set using the MLME-SETKEYS.request primitive and it counts all packets encrypted using the current GTK."

::= { dot11RSNAConfigEntry 7 }

but these only apply for certain values of dot11RSNAConfigGroupRekeyMethod.

Proposed changes:

Change from 4952.15 as follows:

dot11RSNAConfigGroupRekeyTime OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

UNITS "seconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

The time after which the (#1980)(#1509)GTK is (#1382)refreshed (by rekeying), if dot11RSNAConfigGroupRekeyMethod is timeBased(2) or timepacketBased(4). The timer starts at the moment the GTK was set using the MLME-SETKEYS.request primitive."

DEFVAL { 86400 } -- once per day

::= { dot11RSNAConfigEntry 6 }

dot11RSNAConfigGroupRekeyPackets OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

UNITS "1000 packets"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

~~A~~The packet count after which the (#1980)(#1509)GTK is (#1382)refreshed (by rekeying), if dot11RSNAConfigGroupRekeyMethod is packetBased(3) or timepacketBased(4). The packet counter starts at the moment the GTK was set using the MLME-SETKEYS.request primitive and it counts all packets encrypted using th~~e current~~at GTK."

::= { dot11RSNAConfigEntry 7 }

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3719 in <this document>, which make the changes requested.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3409Mark RISON | CID 1927: add a NOTE to say that the SCRAMBLER\_INITIAL\_VALUE is equal to the value in the SERVICE field after scrambling | As it says in the comment |

Discussion:

I think Youhan KIM presented some figures to demonstrate that the initial value of the scrambler (which is what the transmitter cares about) is also the value in the SERVICE field after scrambling (which is what the receiver cares about) is. However, I can’t find these (not in 22/0990 for instance).

In any case, the point is that the receiver doesn’t care about the initial value of the scrambler at the transmitter, the receiver cares about the value in the SERVICE field after scrambling (because that’s what’s used for e.g. MU-RTS/CTS). In general this is made clear through wording like “(the first 7 bits received in the SERVICE field prior to descrambling)”, but not always.

Proposed changes:

Change from 3180.45 as follows:

During reception, an HE STA shall generate the RXVECTOR parameter SCRAMBLER\_INITIAL\_VALUE as the ~~integer representation of the first 7 bits of the scrambling sequence, with the first bit of the scrambling sequence being the LSB of the SCRAMBER\_INITIAL\_VALUE~~ value in the first 7 bits of the SERVICE field prior to descrambling.

Change “Service field” to “SERVICE field” at 559.36/37, 1739.44, 1793.23, 3579.10, 3658.43, 3659.20, 3687.39.

Delete the second “]” at 559.37.

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3409 in <this document>, which clarify that on rx the value is the SERVICE field prior to descrambling, and fix the case of “SERVICE field”.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3795Xiangxin GUB.4.4.24651.16 | not CFDMG:O or not CFDMG:M for CF-End frame? | as commented |

Discussion:

It is indeed the case that a M/O indication is missing:



CF-End can be used to truncate a TXOP under EDCA, but I am not aware of any situations in which CF-End transmission is mandatory, at least when disregarding deprecated/obsolete features. I find evidence that CF-End can be used with DMG, so I am not sure what the “not CFDMG” pertained to. However, FR16 is a reminder that CF-End does not apply to OCB operation.

Proposed resolution:

REVISED

At the referenced location change “not CFDMG” to “NOT CFOCB:O”.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3321Mark RISONC.3 | The DESCRIPTION of dot11SPIdleTimeout is far too generic. This is a DMG service period thing only | As it says in the comment |

Discussion:

dot11SPIdleTimeout is only used in these subclauses:

* 10.39.6.7 Service period recovery (under 10.39.6 Channel access in scheduled DTI (under 10.39 DMG and CMMG channel access))
* 11.3.5.2 Non-AP and non-PCP STA association initiation procedures [in a DMG list item]
* 11.3.5.4 Non-AP and non-PCP STA reassociation initiation procedures [in a DMG list item]

However, only DMG is mentioned, not CMMG, in those subclauses, so this seems to be a DMG-only thing.

Proposed changes:

Change from 5283.40 as follows:

dot11SPIdleTimeout OBJECT-TYPE

SYNTAX Unsigned32 (1..100000)

UNITS "microseconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by the SME or an external management entity.

Changes take effect as soon as practical in the implementation.

This attribute~~e SPIdleTimeout subfield~~ indicates the time during which a DMG STA expects to receive a frame from its partner STA."

DEFVAL { 200 }

::= { dot11DMGOperationEntry 9 }

Proposed resolution:

REVISED

At 5283.50 change “The SPIdleTimeout subfield indicates time during which a STA” to “This attribute indicates the time during which a DMG STA”.

At 5283.34 change “The MinPPDuration subfield” to “This attribute”.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3200Mark RISONC.3 | "The default is" should not appear in the DESCRIPTION, but in a DEFVAL | As it says in the comment |

Discussion:

As it says in the comment, we have DEFVAL for defaults.

Proposed changes:

REVISED

In dot11StationID at 4894.59 delete “Its syntax is MAC address, and the default value is the STA's assigned, unique MAC address.” and after the DESCRIPTION add “DEFVAL { the STA's MAC address }”.

In dot11RMMeasurementPilotPeriod at 4907.3 delete “The default period is 25% of dot11BeaconPeriod.” and after the DESCRIPTION add “DEFVAL { dot11BeaconPeriod / 4 }”.

In dot11RSNAConfigGroupRekeyMethod at 4951.55 delete “The default is time-based, once per day.”

In dot11EDMGOptionImplemented at 5238.61 delete “The default value of this attribute is false.”

In dot11QAPEDCATableMandatory at 5275.57 delete “The default value for this parameter is false.” and after the DESCRIPTION add “DEFVAL { false }”.

In dot11NonAPStationAuthMaxVoiceRate at 5378.41 delete “, which is the default value,”. Ditto for dot11NonAPStationAuthMaxVideoRate, dot11NonAPStationAuthMaxBestEffortRate, dot11NonAPStationAuthMaxBackgroundRate, dot11NonAPStationAuthMaxHCCAHEMMRate, dot11NonAPStationAuthHCCAHEMMDelay, dot11NonAPStationAuthMaxSourceMulticastRate.

What about things like

See Table 9-192

(Default EDCA Parameter Set element (#1660)parameters

if dot11OCBActivated is false and the STA is a non-sensor STA(#251)) and

Table 9-193 (Default EDCA parameter set for STA operation if dot11OCBActi-

vated is true).

?

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3493Mark RISON | The interpretation of the Key ID field in KDEs is not specified | Add sentences of the form "The Key ID field contains ..." |
| CID 3494Mark RISON | The interpretation of some of the fields in KDEs is not specified, e.g. GTK in GTK KDE, MAC Address in MAC Address KDE, | Add sentences of the form "The <blah> field contains ..." |

Discussion:

As these comments say, some KDE fields are not described. Ditto some TK subelement fields.

Also, “Key ID” should have lowercase “key” when not about the name of a field etc., and not at the start of a sentence etc.

Miscellaneous additional small horrors have come to light in the course of examining these issues.

Proposed changes:

At 1038.46 add a para “The Key ID field contains the GTK key ID.”

At 2905.6 add a para “The Key ID field contains the GTK key ID.”

At 2905.12 add a para “The GTK field contains the GTK.”

At 2905.22 add a para “The MAC Address field contains a MAC address.”

At 2905.31 add a para “The PMKID field contains a PMKID.”

At 2905.40 add a para “The Key Nonce field contains a key nonce.”

At 2905.41 change “The Key Lifetime value is expressed in seconds and uses big endian octet order.” to “The Key Lifetime field contains a key lifetime in seconds, in big endian octet order.”

At 2905.45 delete “(in seconds)”.

At 2905.51 change “The Error Type field is in big endian octet order.” to “The Error Type field contains an error type, in big endian octet order.”

At 2906.12 add three paras “The Key ID field contains the IGTK key ID.”, “The IPN field contains the IPN.” and “The IGTK field contains the IGTK.” Move the sentence “The IPN corresponds…” above to the end of the second new para.

At 2908.6 add a para “The Key ID field contains the BIGTK key ID.”

At 2908.10 add a para “The BIGTK field contains the BIGTK.”

At 2908.21 add a para “The Key ID field contains the WIGTK key ID.”

At 2908.26 add a para “The WIGTK field contains the WIGTK.”

At 1038.35 change “The GTK subelement Key Info subfield” to “The Key Info subfield”.

At 2908.16 change “(Length-12)” to “variable”.

At 2908.18 change “WIGTK KDE” to “WIGTK KDE format”.

At 1039.16 change “indicates the value of the BIP key identifier” to “contains the IGTK key ID”.

At 1040.1 change “indicates the value of the BIGTK identifier” to “contains the BIGTK key ID”.

At 1040.25 change “indicates the WIGTK identifier” to “contains the WIGTK key ID”.

At 1634.15 change “indicates the value of the BIP key identifier” to “contains the IGTK key ID”.

At 1634.41 change “indicates the value of the BIGTK identifier” to “contains the BIGTK key ID”.

Change “Key ID” to “key ID” at 492.5/6, 978.56/57, 1046.11(2x)/12, 1159.1, 1320.54, 1321.14 (rightmost), 1476.47 (rightmost), 1722.64, 2313.49, 2841.8/10, 2847.31 (rightmost, also delete “value”), 2859.49/58/59, 2871.8, 2876.60/61, 2881.43/44/45/48/50/51/53, 2907.18 (rightmost), 2917.14/15/18(2x)/63, 3034.41, 4572.17(2x, also delete “value”)/53/54(also delete “value”), 4573.13/14 (also delete “value”), 4575.50/56, 4576.2,

At 338.57/59 change “key identifier” to “PMK identifier”.

Change at 1258.53 as follows:

The Number of Public Key Identifiers subfield ~~lists~~contains the number of Public Key Identifier fields that are present in the Public Key Identifiers field in the FILS Indication element. When the Number of Public Key Identifiers subfield is 0, the Public Key Identifiers field is not present in the FILS Indication element. Each Public Key Identifier field is formatted per Figure 9-729 (Public Key Identifier field format). Up to seven Public Key Identifier~~s~~ fields may be carried in a FILS Indication element.

At 1258.24 change “Public Key Identifier” to “Public Key Identifiers”.

Change at 2911.16 as follows:

{Key Data} is a sequence of zero or more elements and KDEs, concatenated and contained in the Key Data field, where

RSNE is the RSNE, described in 9.4.2.24 (RSNE)

RSNE[KeyName] is the RSNE, with the PMKID List field set to KeyName

GTK[N] is the GTK KDE, with the ~~k~~Key ID~~identifier~~ field set to N (The key ID~~identifier~~ specifies which index is used for this GTK. Index 0 shall not be used for GTKs, except in mixed environments, as described in 12.7.1 (Key hierarchy). (#1457)Index 3 shall not be used for GTKs)

FTE is the (#1776)FTE, described in 9.4.2.47 (FTE(#1776))

MDE is the (#1776)MDE, described in 9.4.2.46 (MDE(#1776))

TIE[IntervalType] is a (#1776)TIE of type IntervalType, as described in 9.4.2.48 (TIE(#1776)), containing e.g., for type KeyLifetime, the lifetime of the FT key hierarchy

IGTK[M] is the IGTK KDE, with the ~~k~~Key ID~~identifier~~ field set to M

IPN is the current IGTK replay counter value provided by the IGTK KDE

BIGTK[Q] is the BIGTK KDE, with the ~~k~~Key ID~~identifier~~ field set to Q

BIPN is the current BIGTK replay counter value provided by the BIGTK KDE

(11ba)WIGTK[R] is the WIGTK KDE, with the ~~k~~Key ID~~identifier~~ field set to R

(11ba)WIPN is the current WIGTK replay counter value provided by the WIGTK KDE

PMKID is ~~of type~~the PMKID KDE and is the ~~key~~PMK identifier used during the 4-way ~~PTK~~ handshake for PMK identification

OCI KDE is ~~a~~the OCI KDE ~~containing operating channel information~~

RSNXE is the RSNXE, described in 9.4.2.241 (RSNXE(#1776))

PMKID is the PMK identifier for~~identifies~~ the PMKSA selected by the Authenticator

“{a} or {b}” means that exactly one of either {a} or {b} is present as the {Key Data}

Change “key identifier” to “key ID” at 2912.42, 2916.25/50, 2922.50/54/58/62, 2923.61/62, 2924.1/3.

Change “TK identifier” to “TK key ID” at 1752.46/49, 2845.53/57/60.

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3493 and 3494 in <this document>, which make the changes requested by the commenter, and fix related issues.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3631Mark RISON12 | The setting of the Secure bit in M1 and M2 of a rekeying 4WH is not clear | Specify that it is indeterminate, and hence must be ignored by the receiver |
| CID 3596Mark RISON12.7.6.1 | It is not clear whether 12.7.6.1 General applies to rekeying, e.g. whether the Secure bit is 0 in M1 and M2 even in rekeying (when it has the old PTK and GTK). Ditto 12.7.2.b)7) Note that if the Secure bit is 1 in M2 rekeying then the Key Information field is the same for M2 and M4 | Clarify the rules for rekeying |

Discussion:

In 12.7.2 we have:

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 1—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.

NOTE 2—The Secure bit is set to 1 in messages 3 and 4 of the 4-way handshake.

I think we ended up with NOTE 1 as a compromise between saying “it shall be 1 when PTK rekeying (because a PTKSA exists at that point)” and “it shall be ignored when PTK rekeying (because some existing implementations set it to 0)”.

However, 12.7.6.1 suggests the Secure bit is always set to 0 in M1 and M2:

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})

And in fact so does 12.7.6.2/3:

Message 1 uses the following values for each of the (#1836)EAPOL-Key PDU fields:

[…]

Secure = 0

Message 2 uses the following values for each of the (#1836)EAPOL-Key PDU fields:

[…]

Secure = 0 – same as message 1

And in fact various state machines assume 0. And indeed fail to cover all the messages!

Also, as CID 3596 points out, the statements about how you can distinguish M1-M4 and G1-G2 are no longer correct.

Proposed changes:

Change 12.7.6.1 as follows:

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

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

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

Change 12.7.6.2 as follows:

Message 1 uses the following values for each of the (#1836)EAPOL-Key PDU fields:

[…]

Secure = 0 in initial 4-way handshake, or 1 when PTK rekeying (but see 12.7.2)

Change 12.7.6.3 as follows:

Message 2 uses the following values for each of the (#1836)EAPOL-Key PDU fields:

[…]

Secure = 0 in initial 4-way handshake, or 1 when PTK rekeying (but see 12.7.2) ~~– same as message 1~~

In the list in 12.7.9.3 Supplicant state machine variables immediately before SNonce add:

— *PTKSAEstablished*. The Supplicant sets this variable to 0 on initialisation and to 1 when a PTKSA has been established.

Change at 2935.52 from:

**if** *A* = 1 && *State* ≠ Failed **then**

Send EAPOL-Key(0,1,0,0,K,0,0,TSNonce,MIC(TPTK),{RSNE})

**endif**

**if** UpdatePTK = 1 **then**

*MLME-SETPROTECTION.request(TA, Rx\_Tx)*

**endif**

to:

**if** *State* ≠ Failed **then**

**if** *K* = P && *M* = 0 && *A* = 1 **then**

Send EAPOL-Key(*PTKSAEstablished*,1,0,0,P,0,0,TSNonce,MIC(*TPTK*),{RSNE}) // M2

**else if** *K* = P && *M* = 1 && *A* = 1 **then**

Send EAPOL-Key(1,1,0,0,P,0,0,0,MIC(*TPTK*),{}) // M4

**else if** *K* = G && *A* = 1 **then**

Send EAPOL-Key(1,1,0,0,G,0,0,0,MIC,{}) // G2

**else**

 *State* ← FAILED

**endif**

**endif**

**if** *State* ≠ Failed && *UpdatePTK* = 1 **then**

*MLME-SETPROTECTION.request(TA, Rx\_Tx)*

*PTKSAEstablished* ← 1

**endif**

At 2934.39 romanise “*P”*.

At 2934.42 change “–“ to “//”.

At 2935.28 change “*KeyData* = GTK” to “*K* = G”.

At 2937.28 change

Send EAPOL-Key( 0, 0, 1, 0, P, 0, 0, ANonce, 0, {})

to:

Send EAPOL-Key(PTK = 0 ? 0 : 1, 0, 1, 0, P, 0, 0, ANonce, 0, {}) // M1

At 2937.44 append “ // M3” after “Send EAPOL-Key(1, 1, 1, Pair, P, 0, RSC, ANonce, MIC(PTK),

{RSNE, GTK[N], IGTK [M]})”.

At 2939.16 append “ // G1” after “Send EAPOL-Key (1, 1, 1, !Pair, G, 0, RSC, 0, MIC(PTK), {GTK[GN]})” and delete the space before the opening paren.

Change 12.7.6.8 as follows:

It is critical to the correctness of the 4-way handshake that at least one bit differs in each message. Within the 4-way handshake, ~~message 1 can be recognized as the only one in which the (#1829)Key MIC Present bit is 0, meaning message 1 does not include the MIC, while message 2 to message 4 do. Message 3 differs from message 2 by not asserting the Ack bit and from message 4 by asserting the Ack Bit. Message 2 differs from message 4 by including the RSNE~~ the messages are distinguished by the Key MIC and Encrypted Key Data bits (not both 0 except in message 1), the Key Ack bit (1 in message 1 and message 3 only) and the presence of RSNEs and/or Multi-Band elements (in message 2 but not in message 4).

~~Request messages are distinct from 4-way handshake messages because the former assert(#1826) the Request bit and 4-way handshake messages do not. Group key handshake messages are distinct from 4-way handshake messages because they assert a different key type.~~

Group key handshake messages are distinct from 4-way handshake messages because they set the Key Type bit differently (0 in group key handshake messages only), and are distinguished from each other by the Key Ack bit (1 in message 1 only). Request messages are distinct from 4-way handshake and group key handshake messages because they set the Request bit differently (1 in request messages only).

At 2918.47 change “none require” to “none required”.

Change 12.7.9.3 as follows:

— AuthenticationRequest. The Supplicant sets this variable to true if its STA’s IEEE 802.11 management entity reports that an SSID is to be authenticated. ~~This might be on association or at other times.~~

Change 12.7.10.3 as follows:

— AuthenticationRequest. This variable is set to true by the STA’s IEEE 802.11 management entity in order to authenticate an association. ~~This can be set to true when the STA associates or at other times.~~

At 2950.32, restore Figure 12-56—FILS Shared Key authentication to what it was in D1.0.

At 2969.57 insert a para:

The same FT 4-way handshake is performed for PTK rekeying, except that the Secure bit is set in the first two messages (but see 12.7.2).

In Figure 13-15—R1KH state machine, including portions of the SME (part 1) move “PTK‑RekeyRequest = false” from the FT-INIT-R1\_SA state to the end of the FT-PTK-START state and in the latter change:

Send EAPOL-Key (0, 0, 1, 0, P, 0, 0, ANonce, 0, {})

to (note deletion of space before the opening paren):

Send EAPOL-Key(PTK-RekeyRequest ? 1 : 0, 0, 1, 0, P, 0, 0, ANonce, 0, {}) // M1

At 2997.46 append “ // M3” after “Send EAPOL-Key (1, 1, 1, 1, P, 0, 0, ANonce, MIC, {RSNE[PMKR1Name],

MDE, GTK[N],  IGTK[M], BIGTK[Q], FTE, TIE[ReassociationDeadline], TIE[KeyLifetime], RSNXE})” and delete the space before the opening paren.

In Figure 13-18—S1KH state machine, including portions of the SME (part 1):

* At the end of R1-START add “PTKRekeying = false”
* Add a new state FT-REKEY that sets “PTKRekeying = true” and then does UCT into FT-INIT-R1-SA
* Move the side arrow into FT-INIT-R1-SA to go into the new FT-REKEY
* In FT-PTK-START change “Send EAPOL-Key (0, 1, 0, 0, P, 0, SNonce, […])” to “Send EAPOL-Key(PTKRekeying ? 1 : 0, 1, 0, 0, P, 0, SNonce, […]) // M2” (note deletion of space before opening paren)

At 3002.36 append “ // M4” after “Send EAPOL-Key (1, 1, 0, 0, P, 0, 0, MIC-KCK)” and delete the space before the opening paren.

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3631, 3596 in <this document>, which indicate that the Secure bit in M1 and M2 is not necessarily 0, and fix various issues with the security pseudocode/state machines.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3532Mark RISON12 | The row ordering in Table 12-7--Cipher suite key lengths seems haphazard | Sort alphabetically |

Discussion:

The reference is incorrect; it should be to Table 12-8:

**Table 12-8—Cipher suite key lengths**

|  |  |  |
| --- | --- | --- |
| **Cipher suite** | **Key length (octets)** | **TK\_bits (bits)** |
| TKIP  | 32 | 256 |
| CCMP-128  | 16 | 128 |
| BIP-CMAC-128  | 16 | 128 |
| GCMP-128  | 16 | 128 |
| GCMP-256  | 32 | 256 |
| CCMP-256  | 32 | 256 |
| BIP-GMAC-128  | 16 | 128 |
| BIP-GMAC-256  | 32 | 256 |
| BIP-CMAC-256 | 32 | 256 |

It might be that this is historically the order in which these suites were added to the standard, but that’s not helpful to the reader.

Proposed changes:

Change Table 12-8 to have the following order:

**Table 12-8—Cipher suite key lengths**

|  |  |  |
| --- | --- | --- |
| **Cipher suite** | **Key length (octets)** | **TK\_bits (bits)** |
| BIP-CMAC-128  | 16 | 128 |
| BIP-CMAC-256 | 32 | 256 |
| BIP-GMAC-128  | 16 | 128 |
| BIP-GMAC-256  | 32 | 256 |
| CCMP-128  | 16 | 128 |
| CCMP-256  | 32 | 256 |
| GCMP-128  | 16 | 128 |
| GCMP-256  | 32 | 256 |
| TKIP  | 32 | 256 |

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3532 in <this document>, which use alphanumeric order for Table 12-8 (Cipher suite key lengths).

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3326Mark RISON9.4.1.9755.21 | "Status code" (name of field) should be "Status Code" | I can provide locations |

Discussion:

There are 75x “Status code” and 354 “Status Code”.

Proposed resolution:

REVISED

Change “Status code” to “Status Code” at 712.15, 728.33, 730.18, 1535.7, 1674.5, 3011.44/47, 3013.11/13.

At 1089.37 change “The Status Code field contains the final IEEE 802.11 Status code, as defined in Table 9-78 (Status codes) in 9.4.1.9 (Status Code field), received at the end of the applicable operation.” to “The Status Code field contains the status code, as defined in Table 9-78 (Status codes) in 9.4.1.9 (Status Code field), received at the end of the applicable operation.”

At 1559.46, 1561.60 change “The Status Code values” to “The Status Code field values”.

At 1626.54 change “the Status code field value is not set to 5” to “the BTM Status Code field is not 5”.

At 1626.56 change “if the Status code subfield contains 0” to “if the BTM Status Code field is 0”.

At 1658.30, 1660.26 change “indicated” to “defined”.

At 2396.26 change “FMS Status code” to “FMS status code”.

At 2627.40 change “Status Code” to “Status Code field”.

At 2627.43 change “a Comeback Delay and Query Response Length both set to 0” to “Comeback Delay and Query Response Length fields both set to 0”.

At 2629.45 change “Status Code” to “Status Code field”.

At 2629.47 change “a GAS Comeback Delay set to 0 and a Query Response Length set to 0” to “and GAS Comeback Delay and Query Response Length fields both set to 0”.

At 2630.1 change “Status Code” to “Status Code field”.

At 2630.3 change “a GAS Comeback Delay set to 0 and a Query Response Length set to 0” to “and GAS Comeback Delay and Query Response Length fields both set to 0”.

At 2630.23 change “a status code equal to GAS\_QUERY\_TIMEOUT” to “a Status Code field set to GAS\_QUERY\_TIMEOUT”.

At 2630.57 change “with status code equal to GAS\_RESPONSE\_NOT\_RECEIVED\_FROM \_SERVER” to “with a Status Code field set to GAS\_RESPONSE\_NOT\_RECEIVED\_FROM\_SERVER”.

At 2825.33 change “a Transaction Sequence Number of 1 and a Status Code of SUCCESS or SAE\_HASH\_TO\_ELEMENT” to “a Transaction Sequence Number field set to 1 and a Status Code field set to indicate SUCCESS or SAE\_HASH\_TO\_ELEMENT”.

At 2826.21 change “a Transaction Sequence Number of 2 and a Status Code of SUCCESS” to “a Transaction Sequence Number field set to 2 and a Status Code field set to indicate SUCCESS”.

Change “Status code” to “status code” at 2831.43/46 (and delete “set to”)/51, 2832.11/13/19/22/33/37/44.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3291Mark RISON21.13387.4 | L\_DATARATE is missing in Table 21-1--TXVECTOR and RXVECTOR parameters (cf. CID 1057) | As it says in the comment |

Discussion:

CID 1057’s resolution was to add the following row to Table 27-1—TXVECTOR and RXVECTOR parameters for HE:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| L\_DATARATE | FORMAT is NON\_HT | Indicates the rate used to transmit the PSDU in megabits per second.Allowed values depend on the value of the NON\_HT\_MODULATIONparameter as follows: ERP-DSSS: 1 and 2 ERP-CCK: 5.5 and 11 ERP-OFDM, NON\_HT\_DUP\_OFDM: 6, 9, 12, 18, 24, 36, 48, and 54 OFDM: 6, 9, 12, 18, 24, 36, 48, and 54 | Y | Y |
| Otherwise | Not present |

Note there was already an L\_LENGTH row, though this just xreffed back to earlier PHYs for non-HE:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| L\_LENGTH | FORMAT is HE\_SU, HE\_MU, or HE\_ER\_SU | Not presentNOTE—The LENGTH field of the L-SIG field for HE PPDU is defined in Equation (27-11) using the TXTIME value defined in 27.4.3 (TXTIME and PSDU\_LENGTH calculation), which in turn depends on other parameters including the TXVECTOR parameter APEP\_LENGTH. | N | N |
| FORMAT is HE\_TB | Indicates the value in the LENGTH field of the L-SIG field in the range of 1 to 4095. The value is obtained from the triggering frame to which the HE TB PPDU is a response. | Y | N |
| Otherwise | See corresponding entry in Table 19-1 (TXVECTOR and RXVECTOR parameters) or Table 21-1 (TXVECTOR and RXVECTOR parameters(#12)). |

Table 19-1—TXVECTOR and RXVECTOR parameters for HT already has L\_DATARATE (and L\_LENGTH), for NON\_HT, HT\_MF and HT\_GF formats.

Table 22-1—TXVECTOR and RXVECTOR parameters for TVHT already has L\_DATARATE (and L\_LENGTH), for NON\_HT and VHT formats.

But Table 21-1—TXVECTOR and RXVECTOR parameters has no L\_DATARATE (or L\_LENGTH).

Proposed changes:

In Table 21-1—TXVECTOR and RXVECTOR parameters, after the NON\_HT\_MODULATION row add the following:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| L\_DATARATE | FORMAT is NON\_HT | Indicates the rate used to transmit the PSDU in megabits per second. The allowed values are 6, 9, 12, 18, 24, 36, 48, and 54. | Y | Y |
| Otherwise | Not present |
| L\_LENGTH | FORMAT is NON\_HT | See corresponding entry in Table 19-1 (TXVECTOR and RXVECTOR parameters). | Y | Y |
| Otherwise | Not present |

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3291 in <this document>, which add L\_DATARATE and L\_LENGTH parameters to the VHT TXVECTOR/RXVECTOR.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3262Mark RISONG.15528.12 | "BlockAck or BlockAckReq frame has the BA Ack Policy or BAR Ack PolicyIndicator field, respectively" -- no such fields | Delete " with the BAR Ack Policysubfield equal to No Acknowledgment"" at 1727.55, "with the BA Ack Policy subfield set to 1 (representingNo Acknowledgment)" at 2002.15, "with the BAR Ack Policy subfield set to 1 (representingNo Acknowledgment)" at 2002.17, the delayed-no-ack row at 5528.12, "sent with the BAR/BA Ack Policy subfield set to NoAcknowledgment" at 5535.32, |

Discussion:

There are indeed no such fields.

Here are the proposed changes:

1727.55: At most one Multi-TID BlockAckReq frame ~~with the BAR Ack Policy subfield equal to No Acknowledgment~~.

2002.15/17: — BlockAck under an immediate policy ~~with the BA Ack Policy subfield set to 1 (representing~~

~~No Acknowledgment)~~

— BlockAckReq under an immediate policy ~~with the BAR Ack Policy subfield set to 1 (representing~~

~~No Acknowledgment)~~

5528.12: *~~delayed-no-ack~~* ~~BlockAck or BlockAckReq frame has the BA Ack Policy or BAR Ack Policy~~

~~Indicator field, respectively, equal to No Acknowlegement.~~

However, the things that use delayed-no-ack also need to be deleted:

5535.31:

(\* A frame-not-requiring-response-ampdu is a frame that does not require a response and can be sent within an A-MPDU. It is ~~one of the delayed BlockAck frames sent with the BAR/BA Ack Policy subfield set to No~~  ~~Acknowledgment, or~~ a Data frame that does not require an immediate ack~~,~~ or an Action No Ack frame. A frame-not-requiring-response may be included with any of the following sequences in any position, except the initial position when this contains a BlockAck frame or Multi-TID BlockAck frame: ppdu-bar, ppdu-ba-bar, ppdu-ba, ppdu-rd, ppdu-rd-bar, ppdu-ba-rd-bar, psmp-ppdu \*)

frame-not-requiring-response-ampdu =

**~~BlockAck~~**~~[+~~*~~HTC~~*~~]+~~*~~delayed-no-ack~~* ~~|~~

**~~BlockAckReq~~**~~[+~~*~~HTC~~*~~]+~~*~~delayed-no-ack~~* ~~|~~

**Data**[+*HTC*]+QoS+block-ack |

ma-no-ack-htc;

Proposed resolution:

REVISED

Make the changes proposed by the commenter and additionally at 5535.32 change “It is one of the delayed BlockAck frames sent with the BAR/BA Ack Policy subfield set to No Acknowledgment, or Data that does not require an immediate ack, or an Action No Ack frame.” to “It is a Data frame that does not require an immediate ack or an Action No Ack frame.” and delete the first two lines after the = (the ones starting BlockAck/BlockAckReq).

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3089John WULLERT10.41820.18 | Notes 1 on this page (and Notes 1 and 2 on page 1821) seem to impose requirements without using normative language, which violates the spirit, but perhaps not the letter, of the rule that Notes cannot be normative. Furthermore, there are no matching requirements in the referenced sections, but rather the required mechanism for constructing the packet numbers will result in them being consecutive. | Revise to state "PN processing will generate consecutive PN numbers for constituent MPDUs of fragmented MSDUs (see 12.5.2.3.2 (PN processing) and 12.5.4.3.2 (PN processing))." |
| CID 3396Mark RISON10.41820.18 | "NOTE 1--Packet numbers for consecutive fragments of an MSDU or MMPDU in an RSNA are required to beconsecutive" should also cover A-MSDUs | Change "of an MSDU or MMPDU" to "of an MSDU, A-MSDU or MMPDU" at 1820.18 and 1821.40 |

Discussion:

With dynamic fragmentation A-MSDUs can now be fragmented too (this was missed in the PN and replay detection subclauses, too).

It is critical that the PNs of a fragmented MSDU/A-MSDU/MMPDU increment by exactly 1, otherwise you get one of the FragAttacks that made the headlines last year.

However, it is arguable that “consecutive” is not immediately obviously the same as “increment by 1”.

Proposed changes:

Change at 1820.18 as follows:

NOTE 1—Packet numbers for consecutive fragments of an MSDU, A-MSDU or MMPDU in an RSNA are required to ~~be consecutive~~increment in steps of 1 (see 12.5.2.3.2 (PN processing) and 12.5.4.3.2 (PN processing)).

Change at 1821.40 as follows:

NOTE 1—Packet numbers for consecutive fragments of an MSDU, A-MSDU or MMPDU in an RSNA are required to ~~be consecutive~~increment in steps of 1 (see 12.5.2.4.4 (PN and replay detection) and 12.5.4.4.4 (PN and replay detection) under d)).

Change at 2845.7 and 2854.49 as follows:

The receiver shall discard MSDUs, A-MSDUs and MMPDUs whose constituent MPDU PN values are not incrementing in steps of 1.

Change at 2587.5 as follows:

Dialog Token field values of consecutive Fine Timing Measurement frames shall ~~be consecutive~~increment in steps of 1

Proposed resolution:

REVISED

In NOTE 1 at 1820.18 and 1821.40 change “be consecutive” to “increment in steps of 1” and add “, A-MSDU” after “MSDU”. Add a full stop at the end of the sentence at 1821.40. At 2845.8 and 2854.50 add “, A-MSDUs” after “MSDUs”. At 2587.6 change “be consecutive” to “increment in steps of 1”.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3312Mark RISON28.2.24237.54 | "If the CH\_BANDWIDTH parameter has two contiguous bits" -> has exactly two contiguous bits set to 1 and no other bits set to 1 | Change from line 54 to:-- If the CH\_BANDWIDTH parameter has a single bit equal to 1 (#2349)(e.g., "01000000") or if theCH\_BANDWIDTH parameter has exactly two bits equal to 1 and they are noncontiguous (e.g., "01001000") and theCHANNEL\_AGGREGATION parameter is set to AGGREGATE, then NCB is set to 1.-- If the CH\_BANDWIDTH parameter has exactly two bits equal to 1 and they are contiguous (e.g., "01100000") and the CHANNEL\_AGGREGATION parameter is set to AGGREGATE, thenNCB is set to 1. Otherwise, if the CHANNEL\_AGGREGATION parameter is set toNOT\_AGGREGATE, then NCB is set to 2.-- If the CH\_BANDWIDTH parameter has exactly three bits equal to 1 and they are contiguous (e.g., "00111000"), then NCB is set to 3.-- If the CH\_BANDWIDTH parameter has exactly four bits equal to 1 and they are contiguous (e.g., "01111000") and the CHANNEL\_AGGREGATION parameter is set to AGGREGATE, thenNCB is set to 2. Otherwise, if CHANNEL\_AGGREGATION parameter is set toNOT\_AGGREGATE, then NCB is set to 4. |
| CID 3313Mark RISON28.2.24237.54 | What about other combinations, e.g. 3 or 4 bits equal to 1, but not contiguous, or >4 bits equal to 1, or 2 bits equal to 1 and not contiguous and CHANNEL\_AGGREGATION not set to AGGREGATE? | As it says in the comment |
| CID 3386Mark RISON28.2.24237.54 | "If the CH\_BANDWIDTH parameter has a single bit equal to 1 (e.g., "01000000") or if the CH\_BANDWIDTH parameter has two non-continguous bits equal to 1 (e.g., "01001000") and the CHANNEL\_AGGREGATION parameter is set to AGGREGATE" precedence unclear | Add comma before "or" |

Discussion:

Yan XIN has provided the following information re EDMG:

* There are only two aggregation cases, 2.16+2.16 GHz and 4.32+4.32 GHz
* If more than 2 bits are set in CH\_BANDWIDTH they are necessarily contiguous
* No more than 4 bits can be set
* For the case that there are exactly 2 bits equal to 1 and these 2 bits are noncontiguous, CHANNEL\_AGGREGATION should be ignored
* “Channel bonding” is different from “channel aggregation”. Channel bonding is defined as two, three or four continuous channels, each 2.16 GHz, bonded together for wide band transmissions (max BW 4x2.16 GHz). Channel aggregation is defined as two contiguous or non-contiguous channels of 2.16 GHz or two contiguous channels of 4.32 GHz (two bonded 2.16 GHz channels), aggregated

Proposed changes:

Change 28.2.2 from:

The NCB parameter represents the number of contiguous (i.e., bonded) 2.16 GHz channels used for a transmission. The value of the CH\_BANDWIDTH and CHANNEL\_AGGREGATION parameters in the TXVECTOR and RXVECTOR define the value of the NCB parameter in the EDMG PHY definition throughout this clause as follows:

— If the CH\_BANDWIDTH parameter has a single bit equal to 1 (#2349)(e.g., “01000000”) or if the CH\_BANDWIDTH parameter has two noncontiguous bits equal to 1 (e.g., “01001000”) and the CHANNEL\_AGGREGATION parameter is set to AGGREGATE, then NCB is set to 1.

— If the CH\_BANDWIDTH parameter has two contiguous bits each of which is equal to 1 (e.g., “01100000”) and the CHANNEL\_AGGREGATION parameter is set to AGGREGATE, then NCB is set to 1. Otherwise, if the CHANNEL\_AGGREGATION parameter is set to NOT\_AGGREGATE, then NCB is set to 2.

— If the CH\_BANDWIDTH parameter has three contiguous bits each of which is equal to 1 (e.g., “00111000”), then NCB is set to 3.

— If the CH\_BANDWIDTH parameter has four contiguous bits each of which is equal to 1 (e.g., “01111000”) and the CHANNEL\_AGGREGATION parameter is set to AGGREGATE, then NCB is set to 2. Otherwise, if CHANNEL\_AGGREGATION parameter is set to NOT\_AGGREGATE, then NCB is set to 4.

to:

The NCB parameter represents the number of contiguous (i.e., bonded) 2.16 GHz channels used for a transmission. The value of the CH\_BANDWIDTH and CHANNEL\_AGGREGATION parameters in the TXVECTOR and RXVECTOR define the value of the NCB parameter in the EDMG PHY definition throughout this clause as follows:

NOTE—Between 1 and 4 bits are set in the CH\_BANDWIDTH parameter.

— If the CH\_BANDWIDTH parameter has exactly 1 bit equal to 1 (#2349)(e.g., “01000000”), then NCB is set to 1.

NOTE—The CHANNEL\_AGGREGATION parameter is ignored in this case.

— If the CH\_BANDWIDTH parameter has exactly 2 bits equal to 1, then:

—If the 2 bits are noncontiguous (e.g., “01001000”), then NCB is set to 1.

NOTE—The CHANNEL\_AGGREGATION parameter is ignored in this case.

— If the 2 bits are contiguous (e.g., “01100000”), then if the CHANNEL\_AGGREGATION parameter is set to AGGREGATE, NCB is set to 1, otherwise NCB is set to 2.

— If the CH\_BANDWIDTH parameter has exactly 3 bits equal to 1 (e.g., “00111000”), then NCB is set to 3.

NOTE—The 3 bits are necessarily contiguous in this case. The CHANNEL\_AGGREGATION parameter is ignored in this case.

— If the CH\_BANDWIDTH parameter has exactly 4 bits equal to 1 (e.g., “01111000”), then if the CHANNEL\_AGGREGATION parameter is set to AGGREGATE, NCB is set to 2, otherwise NCB is set to 4.

NOTE—The 4 bits are necessarily contiguous in this case.

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CIDs 3312, 3313, 3386 in <this document>, which address the issues identified (note CHANNEL\_AGGREGATION ignored when two non-contiguous bits, bits necessarily contiguous if >2 set).

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3488Mark RISONC.35136 | dot11WNMEventRsnaRprtRsnElement refers to "RSNE field" but should refer to "RSNE" | Change "RSNE field" to "RSNE" 3x on referenced page |

Discussion:

There is an RSNE field in the RSNA event report (see Figure 9-472—Event Report format for RSNA event). But the descriptions are rather confusing, especially since they talk of “the entire contents of the negotiated RSNE”..

Proposed changes:

Change at 1077.36 as follows:

The RSNE field contains ~~the entire contents of~~ the negotiated RSNE at the time of the authentication attempt~~. The maximum length of the RSNE field is less than the maximum length of an RSNE, as defined in 9.4.2.24 (RSNE). If the length of the RSNE included here exceeds the maximum length of the RSNE field, the RSNE is~~, truncated to the maximum length allowed for the RSNE field if necessary.

Change at 5136.59 as follows:

This attribute contains ~~the entire contents of~~ the negotiated RSNE at the time of the authentication attempt~~. The maximum length of the RSNE field is less than the maximum length of an RSNE, as defined in 9.4.2.24 (RSNE). If the length of the RSNE included here exceeds the maximum length of the RSNE field, the RSNE shall be~~, truncated to the maximum length allowed for the RSNE field in the RSNA event report, if necessary."

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3488 in <this document>, which clarify the reference to the RSNE field in the RSNA event report.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3384Mark RISON9.8.3.11735.58 | "PV1 frames with Type subfield value equal to 0 define a PV1 QoS Data frame where either A1 or A2 field isan SID as indicated in Table 9-639 (From DS subfield values in PV1 frames(#278)) and the other A1 or A2" etc. seems to duplicate the nearby table | Delete the para at the referenced location |

Discussion:

We have (green/cyan = common to both table and text, red/purple = not common to both table and text):

**Table 9-638—PV1 frame types**

|  |  |  |
| --- | --- | --- |
| **Type value** | **Type** | **Description** |
| 0 | QoS Data | Either the A1 field or the A2 field is an SID (defined in 9.8.3.2 (Address fields)), as determined by the From DS subfield in the Frame Control field. |
| 1 | Management | Both A1 and A2 fields contain MAC addresses for PV1 Probe Response frames, or Either the A1 field or the A2 field is an SID (defined in 9.8.3.2 (Address fields)), as determined by the From DS subfield in the Frame Control field. |
| 2 | Control | The A1 field is an SID and the A2 field is either an SID or contains a MAC address. |
| 3 | QoS Data | Both A1 and A2 fields contain MAC addresses. |
| 4-6 | Reserved |  |
| 7 | Reserved for extension |  |

PV1 frames with Type subfield value equal to 0 define a PV1 QoS Data frame where either A1 or A2 field is an SID as indicated in Table 9-639 (From DS subfield values in PV1 frames(#278)) and the other A1 or A2 field contains a MAC address. PV1 frames with Type subfield value equal to 1 define a PV1 Management frame where either A1 or A2 field is an SID as indicated in Table 9-639 (From DS subfield values in PV1 frames(#278)) and the other A1 or A2 field contains a MAC address. PV1 frames with Type subfield value equal to 2 define PV1 Control frames. PV1 frames with Type subfield value equal to 3 define a PV1 QoS Data frame where both A1 and A2 fields contain MAC addresses. All other values of the Type subfield are reserved.

Note that the table allows PV1 Probe Response frames to have two MAC addresses, while the text does not. The table is correct.

Proposed changes:

Delete the para at 1735.58 and change Table 9-638 as follows:

**Table 9-638—PV1 frame types**

|  |  |  |
| --- | --- | --- |
| **Type value** | **Type** | **Description** |
| 0 | QoS Data | Either the A1 field or the A2 field is an SID (defined in 9.8.3.2 (Address fields)), as determined by the From DS subfield in the Frame Control field (see Table 9-639), and the other field contains a MAC address. |
| 1 | Management | For PV1 Probe Response frames: b~~B~~oth A1 and A2 fields contain MAC addresses ~~for PV1 Probe Response frames,~~ Otherwise: e~~or~~ ~~E~~ither the A1 field or the A2 field is an SID (defined in 9.8.3.2 (Address fields)), as determined by the From DS subfield in the Frame Control field (see Table 9-639), and the other field contains a MAC address. |
| 2 | Control | The A1 field is an SID and the A2 field is either an SID or contains a MAC address. |
| 3 | QoS Data | Both A1 and A2 fields contain MAC addresses. |
| 4-6 | Reserved |  |
| 7 | Reserved for extension |  |

At 1735.19 change “End of Service Period” to “EOSP”.

At 1736.15 in “The From DS subfield, if present, defines the addressing of PV1 frames with values of the Type field less than 2” delete “, if present, ”.

At 1736.19 change “From DS subfield values in PV1 frames” to “From DS subfield values in type 0 or 1 PV1 frames”.

At 1735.5 change “PV1 Probe Request frame” to “PV1 Probe Response frame”.

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID xxx in <this document>, which xxx

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3216Mark RISON9.4.2.21.13 | It is not clear what angles are relative to, or measured (e.g. is it anticlockwise from X axis +ve, or clockwise from Y-axis +ve), and sometimes not clear what they are for (e.g. for ellipsoids) | Specify that angles are from the positive X-axis, anticlockwise |
| CID 3217Mark RISON9.4.2.21.13951.41 | Figure 9-324-- Ellipse Location Shape Value ... Angle field is angle of what? | Change "The Angle field contains the angle of the ellipse." to "The Angle field contains the angle of the major axis of ellipse anticlockwise from the positive X-axis." |
| CID 3226Mark RISON9.4.2.21.13948.55 | "A Shape is specified with respect to either a 2-Dimensional or 3-Dimensional Coordinate ReferenceSystem where each point in the shape defines the direction from the Location Reference value's startingpoint. A positive X-axis value corresponds to an easterly direction relative to the Location Reference value'sstarting point; a negative X-axis value corresponds to a westerly direction relative to the Location Referencevalue's starting point; a positive Y-axis value corresponds to a northerly direction relative to the LocationReference value's starting point; a negative Y-axis value corresponds to a southerly direction relative to theLocation Reference value's starting point and the Z-axis value corresponds to the altitude above thehorizontal plane at the Location Reference value's starting point." -- need to also define what angles correspond to (which axis, and which direction is a positive angle) | After the cited text add "An angle is measured anticlockwise from the positive X-axis towards the Y-axis." |
| CID 3218Mark RISON9.4.2.21.13952.21 | What is an arcband? | Define an arcband |
| CID 3227Mark RISON9.4.2.21.13952.21 | An "arcband" is not well-defined, especially what "Start Angle" and "Opening Angle" are | Define an arcband and the start/opening angles |

Discussion:

The specification of location references was derived from RFC 5491. This has:

5. Geodetic Shape Representation

 Angles

 representing bearings are measured in a clockwise direction from

 Northing […]

5.2.4. Ellipse

 An elliptical area describes an ellipse in two-dimensional space.

 The ellipse is described by a center point, the length of its semi-

 major and semi-minor axes, and the orientation of the semi-major

 axis. […]

 The gs:orientation element is the angle by which the semi-major axis

 is rotated from the first axis of the CRS towards the second axis.

 For WGS 84, the orientation indicates rotation from Northing to

 Easting

5.2.5. Arc Band

 The arc band shape type is commonly generated in wireless systems

 where timing advance or code offsets sequences are used to compensate

 for distances between handsets and the access point. The arc band is

 represented as two radii emanating from a central point, and two

 angles that represent the starting angle and the opening angle of the

 arc. […]

 For example, Paul is using a cellular wireless device and is 7 timing

 advance symbols away from the cell tower. For a GSM-based network,

 this would place Paul roughly between 3,594 meters and 4,148 meters

 from the cell tower, providing the inner and outer radius values. If

 the start angle is 20 degrees from north, and the opening angle is

 120 degrees, an arc band representing Paul's location would look

 similar to Figure 11.

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 |--. / `.

 | `/ \

 | /\_\_ \

 | . `-. \

 | . `. \

 |. \ \ .

 ---c-- a(o) -- | | -->

 |. / 120 ' | E

 | . / '

 | . / ;

 .,' /

 r(i)`. /

 (3594m) `. /

 `. ,'

 `. ,'

 r(o)`'

 (4148m)

 Figure 11: Example of an Arc Band

5.2.7. Ellipsoid

 The ellipsoid is the volume most commonly produced by GPS systems.

 It is used extensively in navigation systems and wireless location

 networks. The ellipsoid is constructed around a central point

 specified in three dimensions, and three axes perpendicular to one

 another are extended outwards from this point. These axes are

 defined as the semi-major (M) axis, the semi-minor (m) axis, and the

 vertical (v) axis, respectively. An angle is used to express the

 orientation of the ellipsoid. The orientation angle is measured in

 degrees from north, and represents the direction of the semi-major

 axis from the center point.

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 `-...........-'

 Figure 14: Example of an Ellipsoid

Proposed changes:

In Clause 2 add:

IETF RFC 5941, GEOPRIV Presence Information Data Format Location Object (PIDF-LO) Usage Clarification, Considerations, and Recommendations, Mar. 2001.

Change at 951.41 as follows:

The Angle field contains the angle of the semi-major axis of the ellipse, measured clockwise from north (see IETF RFC 5941).

Change at 952.8 as follows:

The Angle field contains the angle of the semi-major axis of the ellipsoid, measured clockwise from north (see IETF RFC 5941).

NOTE—The semi-major axis lies in the XY-plane.

At the start of the para at 952.21 add:

 An arcband is defined in IETF RFC 5941.

Change at 952.45 as follows:

The Start Angle field contains the start angle of the arcband, measured clockwise from north (see IETF RFC 5941).

The Opening Angle field contains the opening angle of the arcband (see IETF RFC 5941).

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID xxx in <this document>, which xxx

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3502Mark RISON9.4.2.621064.20 | "The Offset field is the time in microseconds between TSF 0 and the start of a first Awake Window.See 11.2.3.12 (TDLS peer power save mode). " -- but the TSF is 8 octets and the Offset field is only 4 octets | Change the first cited text to "The Offset field is the time in microseconds between intervals specified by the Interval field, starting at TSF 0, and the start of the Awake Window, in microseconds." |
| CID 3503Mark RISON9.4.2.621064.20 | "The Offset field is the time in microseconds between TSF 0 and the start of a first Awake Window.See 11.2.3.12 (TDLS peer power save mode). " -- doesn't seem compatible with "Awake Windows begin at TSF values that satisfy the equation TSF mod Interval = Offset." at 2390.60 | Change the first cited text to "The Offset field is the time in microseconds between intervals specified by the Interval field, starting at TSF 0, and the start of the Awake Window, in microseconds." |

Discussion:

The Offset field cannot be the time of the first Awake Window (sic) since that would mean that you couldn’t set up TDLS peer PSM 232 µs =~ an hour after the BSS had started (or less, since it doesn’t actually seemed to be specified that the TSF shall be 0 when the BSS is started!). This was probably intended to refer to a notional first Awake Window, but this has potential for confusion. The term “TSF 0” also has potential for confusion, as it is not defined.

The way it can all work is if:

* The Interval field defines points in time starting when TSF was 0 and occurring with that interval
* The Offset field defines points in time relative to the points in time defined by the Interval field
* The Awake Windows are those starting at the points in time defined by the (Interval and) Offset field, starting after the TDLS Peer PSM Response frame is received

This matches the equation in 11.2.3.12.

Proposed changes:

Change in 9.4.2.62 Wakeup Schedule element from:

The Offset field is the time in microseconds between TSF 0 and the start of a first Awake Window. See 11.2.3.12 (TDLS peer power save mode).

The Interval field is set to the time in microseconds between the start of two successive Awake Windows. See 11.2.3.12 (TDLS peer power save mode).

to:

The Offset and Interval fields are in microseconds and define when Awake Windows begin. See Equation (11-x) in 11.2.3.12 (TDLS peer power save mode). The Interval field is nonzero and the Offset field is less than the Interval field.

Change in 11.2.3.12 TDLS peer power save mode from:

Awake Windows begin at TSF values that satisfy the equation TSF mod Interval = Offset. The interval between the start of two successive Awake Windows is equal to the time in microseconds of the Interval field. The periodic wakeup schedule may be unrelated to the target beacon transmission time (TBTT) or the beacon interval.

to:

Awake Windows begin at TSF values that satisfy Equation (11-x) and that are after the TDLS Peer PSM Request/Response frame exchange has completed, where Interval and Offset are the fields of the Wakeup Schedule element.

 TSF mod Interval = Offset (11-x)

NOTE—The Awake Window timings might not be related to the beacon timings (TBTTs).

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID 3502 and 3503 in <this document>, which clarify that the Awake Windows start when TSF % Interval = Offset, after the TDLS Peer PSM Request/Response exchange has completed.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3327Mark RISON12.4.8.6.32831.49 | "the frame shall be processed by first checking whethera password identifier is present. If so and there is no password associated with that identifier, BadID shall be setand the protocol instance shall construct and transmit an Authentication frame with Status Code set toUNKNOWN\_PASSWORD\_IDENTIFIER" -- no Del event (cf. previous and next step)? | Send a Del event to the parent process in this case |

Discussion:

Jouni MALINEN has confirmed that a Del event is indeed missing (see Figure 12-15).

Proposed resolution:

REVISED

At 2831.45 after “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” append “, and a Del event shall be sent to the parent process” (with Del italicised).

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3650Mark RISON12 | The same SNonce should be reused until a valid M3 has been received, to avoid DoS attacks (see <https://theory.stanford.edu/~jcm/papers/fp09-he.pdf> ) | Make this recommendation (as a "should") |

Discussion:

Jouni MALINEN concurs that it would “make sense for the standard to promote this relatively strongly”.

Proposed resolution:

REVISED

In Clause B add:

[Bxx] He, C. and Mitchell, J.C., *Analysis of the 802.11i 4-Way Handshake*, WiSE’04, Oct. 2004

italicising the title.

At 2913.54, after “Generates a new nonce SNonce” append “, if it has not already generated one for this 4-way handshake (see [Bxx]); otherwise it should reuse the same SNonce”.

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3573Mark RISON12.5 | There are replay counters for PMF (one for each of individually addressed robust Management and individually addressed robust PV1 Management) and for QMF (one for each ACI of individually addressed robust Management -- it's not clear whether this is also used for individually addressed robust PV1 management or whether there's a separate set of 4) | Explicitly identify the full set of replay counters |
| CID 3574Mark RISON12.5 | There is one RC for unicast robust Management and there are four RCs for unicast QMF. It is not clear when the former will be used, if QMF is enabled for the link | Explicitly identify the use of the RC for unicast robust Management frames when QMF is enabled |

Discussion:

For PV0 we have in 12.5.2.4.1:

a)5) The decryption processing prevents replay of MPDUs by validating that the PN in the MPDU is greater than the replay counter maintained for the session(#193), and TID (for Data frames) or ACI (for QMFs).

For PV1 we have in 12.5.2.4.1:

b)6) The decryption processing prevents replay of MPDUs by validating that the PN in the (#193)locally constructed CCMP header (see 12.5.2.3.6 (Construct CCMP header for PV1 MPDUs)) is greater than the replay counter maintained for the session, and TID (for Data frames) or ACI (for QMFs).

We also have in 12.5.2.4.4:

b) For each PTKSA, (#166)TPKSA, GTKSA, (#1627)mesh PTKSA, and mesh GTKSA(#239), the recipient shall maintain a separate replay counter for each TID, subject to the limitation of the number of supported replay counters

c) If the recipient set the MFPC bit on a given link to 1, it(#199) shall maintain a single replay counter for received individually addressed robust Management frames that are received with the To DS subfield equal to 0, and a single replay counter for received individually addressed robust PV1 Management frames and shall use the PN from the received frame to detect replays. If dot11QMFActivated is also true, the recipient shall maintain an additional replay counter for each ACI for received individually addressed robust Management frames and robust PV1 Management frames(#1681), where these frames are received with the To DS subfield equal to 1.

and in 12.5.3.4:

When management frame protection is negotiated, the receiver shall maintain a 48-bit replay counter for each IGTK.

[…]

When dot11QMFActivated is true, the receiver shall maintain an additional replay counter for each ACI for received group addressed robust Management frames that use QMF.

If dot11RSNAProtectedManagementFramesActivated is true and dot11MeshSecurityActivated is true, the recipient shall maintain a single replay counter for received group addressed robust Management frames that do not use the QMF service and shall use the PN from the received frame to detect replays. If dot11QMFActivated is also true, the recipient shall maintain an additional replay counter for each ACI for received group addressed robust Management frames that use the QMF service.

and in 12.5.3.6:

1) If the frame is a robust Management frame but not a GQMF, the receiver shall compare this MME IPN(#1422) to the value of the (#1504)replay counter for the IGTK identified by the MME Key ID field. […]

2) If the frame is a robust Management frame and also a GQMF, the receiver shall compare this MME IPN(#1422) to the value of the (#1504)replay counter for the IGTK identified by the MME Key ID field and the AC represented by the value of the ACI subfield of the received frame.

So for PV0 Management frames, there’s a replay counter for To DS = 0 if PMF and additionally a replay counter per ACI for To DS = 1 if QMF. But for PV1 Management frames the single replay counter appears to be used when To DS = 1 even if there’s also the replay counters per ACI if QMF.

… but PV1 frames don’t have a To DS field! Dave GOODALL has clarified:

* QMF is not supported for PV1. To support it would probably require a number of changes to differentiate between QMF and non-QMF PV1 management frames, provide additional PNs for each traffic priority and modify the language around use of the sequence number for PV1 frame security to account for the different size of the sequence number field in QMF frames.
* PV1 Data and Management frames are supported by sensor non-AP STAs and APs that advertise support for sensor STAs in the STA Type Support field in the S1G Capabilities element. If an AP advertises that it only supports non-sensor STAs then PV1 Management frames are never used by that AP or its associated STAs. Industry currently is only testing non-sensor STA support.
* If we specify that QMF does not apply to PV1 management frames then that will be acceptable.

Hypothesis on replay counters:

* PTK: per-TID Data (subject to max), also iff PMF: one Management, one PV1 Management iff S1G, per-ACI Management iff QMF (then the one Management is for non-QMF, based on To DS field)
* GTK: per-TID Data (subject to max); non-AP STA only
* IGTK (iff PMF): one Management, ?one PV1 Management iff S1G, per-ACI Management iff QMF (then the one Management is for non-QMF, based on To DS field); non-AP STA only

Proposed changes:

In 11.24.1.1 add a bullet “— The frame is not a PV1 Management frame.” at 2652.5/14/23.

Change 12.5.2.4.4 PN and replay detection as follows:

c) If the recipient set the MFPC bit on a given link to 1, it(#199) shall maintain a single replay counter for received individually addressed non-PV1 robust Management frames that are received with the To DS subfield equal to 0, and a single replay counter for received individually addressed robust PV1 Management frames and shall use the PN from the received frame to detect replays. If dot11QMFActivated is also true, the recipient shall maintain an additional replay counter for each ACI for received individually addressed non-PV1 robust Management frames ~~and robust PV1 Management frames(#1681), where these frames~~that are received with the To DS subfield equal to 1.

NOTE—QMF is not supported for PV1 frames.

c) If the recipient set the MFPC bit on a given link to 1, it(#199) shall maintain a single replay counter for received individually addressed robust Management frames that are received with the To DS subfield equal to 0, and a single replay counter for received individually addressed robust PV1 Management frames and shall use the PN from the received frame to detect replays. If dot11QMFActivated is also true, the recipient shall maintain an additional replay counter for each ACI for received individually addressed robust Management frames and robust PV1 Management frames(#1681), where these frames are received with the To DS subfield equal to 1. The QMF receiver shall use the ACI encoded in the Sequence Number field of the received frame to select the replay counter to use for the received frame, and shall use the PN from the received frame to detect replays. A replayed frame occurs when the PN from the frame is less than or equal to the current value of the management frame replay counter that corresponds to the ACI of the frame.

d) The receiver shall discard any Data frame that is received with its PN less than or equal to the value of the replay counter that is associated with the TA and priority value of the received MPDU. The receiver shall discard MSDUs and MMPDUs whose constituent MPDU PN values are not incrementing in steps of 1. (#199)If the receiver set the MFPC bit on a given link to 1, it shall discard any individually addressed robust Management frame that is received with its PN less than or equal to the value of the replay counter associated with the TA of that individually addressed Management frame.

=>

c) If the recipient set the MFPC bit on a given link to 1, it(#199) shall maintain a single replay counter for received individually addressed non-PV1 robust Management frames that are received with the To DS subfield equal to 0, and (S1G STA only) a single replay counter for received individually addressed robust PV1 Management frames and shall use the PN from the received frame to detect replays. If dot11QMFActivated is also true, the recipient shall maintain an additional replay counter for each ACI for received individually addressed non-PV1 robust Management frames ~~and robust PV1 Management frames(#1681), where these frames~~that are received with the To DS subfield equal to 1. The QMF receiver shall use the ACI encoded in the Sequence Number field of the received frame to select the replay counter to use for the received frame, and shall use the PN from the received frame to detect replays. ~~A replayed frame occurs when the PN from the frame is less than or equal to the current value of the management frame replay counter that corresponds to the ACI of the frame.~~

NOTE—QMF is not supported for PV1 Management frames.

d) The receiver shall discard any Data frame that is received with its PN less than or equal to the value of the replay counter that is associated with the TA and priority value of the received MPDU. The receiver shall discard MSDUs and MMPDUs whose constituent MPDU PN values are not incrementing in steps of 1. (#199)If the receiver set the MFPC bit on a given link to 1, it shall discard any individually addressed robust Management frame that is received with its PN less than or equal to the value of the replay counter associated with the TA and (S1G STA only) Protocol Value field (and ACI, for a QMF receiver of an individually addressed non-PV1 robust Management frame with the To DS subfield equal to 1) of that individually addressed Management frame.

Change 12.5.2.4.1 as follows:

b) For secure PV1 MPDUs, CCMP encrypts the Frame Body field of a plaintext MPDU and encapsulates the resulting cipher text using the following steps:

1) When the sequence number of the MPDU is less than the previous sequence number and satisfies the BPN update conditions in 12.5.2.3.6 (Construct CCMP header for PV1 MPDUs), for that (#37)(#193)PTID, ~~(~~for Data frames~~) or ACI (for QMFs)~~, increment the base PN so that the PN never repeats for the same temporal key and (#37)PTID/ACI.

NOTE 2—Retransmitted MPDUs are not modified on retransmission.

NOTE 3—QMF is not supported for PV1 frames.

2) Use the fields in the MPDU header to construct the AAD for CCM. The CCM algorithm provides integrity protection for the fields included in the AAD. MPDU header fields that might change when retransmitted are muted by being (#1951)masked out when calculating the AAD.

3) Construct the (#209)CCM nonce as defined in 12.5.2.3.4 (Construct CCM nonce) from the PN, A2, and the priority value of the MPDU, where A2 is the STA MAC address identified by the A2 field of the MPDU. If the MPDU is a QoS Data MPDU, the priority value of the MPDU is equal to the value of the PTID subfield of the Frame Control field. ~~If the Type field of the Frame Control field is 001 (Management frame) and the frame is a QMF, the priority value of the MPDU is equal to the value in the ACI subfield of the Sequence Number field.~~ Otherwise, the priority value of the MPDU is equal to the fixed value 0.

Change 12.5.2.3.2 PN processing as follows:

The PN is incremented by a positive number for each MPDU. The PN shall be incremented in steps of 1 for constituent MPDUs of fragmented MSDUs, (11ax)A-MSDUs, and MMPDUs. For PV0 MPDUs, the PN shall never repeat for a series of encrypted MPDUs using the same temporal key. For PV1 MPDUs, the PN shall never repeat for a series of encrypted MPDUs using the same temporal key and (for Data frames) (#37)(#193)PTID ~~(for Data frames) or ACI (for QMFs)~~.

Change 12.5.3.4 BIP replay protection as follows:

When dot11QMFActivated is true, the receiver shall maintain an additional replay counter for each ACI for received group addressed robust Management frames that use QMF. The receiver shall use the ACI encoded in the Sequence Number field of received GQMFs protected by BIP to select the replay counter to use for the received frame, and shall use the IPN from the received frame to detect replays.

NOTE—QMF is not supported for PV1 frames.

If dot11RSNAProtectedManagementFramesActivated is true and dot11MeshSecurityActivated is true, the recipient shall maintain a single replay counter for received group addressed robust Management frames that do not use the QMF service and shall use the PN from the received frame to detect replays. If dot11QMFActivated is also true, the recipient shall maintain an additional replay counter for each ACI for received group addressed robust Management frames that use the QMF service. The QMF receiver shall use the ACI encoded in the Sequence Number field of the received frame to select the replay counter to use for the received frame, and shall use the PN from the received frame to detect replays. A replayed frame occurs when the PN from the frame is less than or equal to the value of the management frame replay counter that corresponds to the ACI of the frame. The transmitter shall preserve the order of protected robust Management frames transmitted to the same DA without the QMF service. When the QMF service is used, the transmitter shall not reorder robust GQMFs within an AC when the frames are transmitted to the same RA.

In 12.5.3.5 BIP transmission after a) and in 12.5.3.6 BIP reception after b)1) add:

NOTE—QMF is not supported for PV1 frames.

Make equivalent changes in the GCMP subclauses, but only for PV0 (“An S1G STA shall not use PV1 frames when using GCMP encapsulation.” in 12.5.4.1).

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID xxx in <this document>, which xxx

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 3578Mark RISON12.6.21 | It is not clear how rekeying is performed in an MBSS | State that the same rules on Auth/Supp roles are used for the rekeying 4WH as for the initial 4WH |

Discussion:

Mesh doesn’t use the 4WH/GKH, it uses the AMPE/mesh GKH.

This is mentioned at the end of 14.5 for pairwise operation:

The MTK is used to protect communications between two peer STAs. The local STA and peer STA derive an MTK per peering instance and may rekey the MTK using AMPE.

and at the start of 14.6 for group operation:

The mesh group key handshake may be used by either mesh STA, after a secure mesh peering has been established, to update the MGTK that it uses to protect group addressed MPDUs that it transmits to its peer mesh STAs.

Proposed resolution:

REVISED

In 14.5.7 change “using AMPE” to “using the AMPE”.

In 14.6 Mesh group key handshake change “to update the MGTK” to “to rekey the MTK”.

TBD:

3693: provide “subfield” locations

3726: “MIB attribute” in C.3 (see also 11-15/355r13)

~3185 provide updated figures

3174 how does modifying BA agreement work (11.5.2 v 10.25.2 last para)

3289 add dot11BSSColorCollisionMaxReports

3485: In Table 27-53--HE PHY MIB attributes why do we have both dot11VHTChannelWidthOptionImplemented and dot11HEChannelWidthOptionImplemented

3629: Follow-up to CID 164: make the changes shown in <https://www.ieee802.org/11/email/stds-802-11-tgm/msg02488.html>

3522: RA/TA/SA/DA “values”

3291: xreffing to earlier PHYs (Youhan looking at this)

3375/3514: “Its value is determined by device capabilities” (also post to reflector)

3544: "header field[s]" in Clause 20 and children clauses should be "Header field"

3659: Sometimes fields described as "(optional)" in their defining figure don't say ", if present," in their description

3667: Don't use hyphens for minuses

3668: Figures should not have xrefs unless they will automatically be updated when the xref number changes, otherwise there will be spec rot

3677: Some of the PICS selectors have unnecessary outside parens

3679: Things like "See 11.22.2.4 (Peer-to-peer link" should not be in DESCRIPTIONs unless there is a REFERENCE line to give the revision. Actually should be entirely in the REFERENCE line

3681: "vendor-specific element" (case-insensitively) should be "Vendor Specific element" and otherwise "vendor-specific" should be "vendor specific" (case-preservingly)

3700: The use of "or both" (~77x) implies that uses of "or" without and "or both" are exclusive, but this is not the case

3701: Should not have a comma before a modal verb (when not the end of a subclause or list)

3705: There are many editorial issues with the description of subelements (19/0856)

3723: "Key ID" should be "key ID" when not at the start of a sentence etc. and not followed by "field" etc.

3733: Delete "(bit <n>)" when it just duplicates info already in a figure or table

3735: "Classifier Parameter" is sometimes spuriously capitalised. Also "the Classifier.". Also "Classifier Type" and words after it inconsistent too

3343: CID 1851 changes to change "PTKSA" to "any PTKSA(s)" (because you could be doing EKIDs) should be done throughout

3433: In ranges expressed as x-y the hyphen should be a minus or en dash (in some places hyphens or em dashes are used

3543: "counter value" should just be "counter"

3545: "any STA" is the same as "a STA" and the latter would be more consistent so should be used

3586: "is an unsigned integer" is not needed in Clause 9 since covered by 9.2.2

3623: Identifiers should not have spaces in them

3625: "Vendor-Specific" should have a space, not a hyphen. Also case sometimes wrong ("Vendor-specific" or "vendor-specific" or "Vendor specific" or "vendor specific")

3627: The list of AANs in 9.4.1.1 Authentication Algorithm Number field should be a table

3645: CID 238 follow-up. I expect folding in new amendments will have added abbreviations that are not expanded on first use in each definition.

3706: "The structure of this/the blah field/element" is a bit odd

|  |  |  |
| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID xxxMark RISON |  |  |

Discussion:

Proposed changes:

Proposed resolution:

REVISED

Make the changes shown under “Proposed changes” for CID xxx in <this document>, which xxx

**References:**

802.11me/D2.0 except where otherwise specified