IEEE P802.11
Wireless LANs

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| 802.11[Resolutions to CID 2115](relative to IEEE 802.11 REVmd D2.0) |
| Date: 2018-08-21 |
| Author(s): |
| Name | Company | Address | Phone | Email |
| Ganesh Venkatesan | Intel Corporation | 2111 NE 25th Ave, Hillsboro, OR 97124 | 503 334 6720 | ganesh.venkatesan@intel.com |
| Das, Dibakar | Intel Corporation | 2111 NE 25th Ave, Hillsboro, OR 97124 |  | Dibakar.das@intel.com  |

**Abstract**

This submission proposes resolutions to CID 2115.

History:

R0: Initial Version

R1: Incorporate comments received during the discussion of R0 of this submission at the Thu PM2 slot in the July 2019 meeting; and offline comments/e-mail discussions with Mark Rison.

R2: Updated to include fixing subfields that are referred to as fields in Clause 11.22.6.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  2115 | Dibakar Das | 9.4.2.167 | 1333 | 28 | The sentence: "The responding STA'sTSF timer at the start of the first burst instance of an FTM session is limited to less than 62/64 of 65 536 TUs(<63 488 TUs) ahead of the TSF time at which the STA transmits the Fine Timing Measurement frame and1/64 of 65 536 TUs earlier (inclusive) (ΓëÑ1024 TUs) than the TSF time at which the STA transmits the FineTiming Measurement frame, as shown in Figure 9-619 (Calculation of Partial TSF Timer field(#1353))"  is convoluted as it specifies the restricts the time of occurence of a scheduled event relative to another event which depends on channel availability. This does not clearly reflect the intent of the statement which is to specify the allowed range of the Partial TSF Timer field value and the time at which the FTM frame containing this field is sent. | Revise the sentence to clarify. For example, " The Partial TSF Timer field value shall satisfy the following rules:1. The value of this field is not greater than  the TSF time at which the STA transmits the Fine Timing Measurement frame containing this field plus 62/64 of 65536 TUs (i.e., 63 488 TUs).2. The value of this field is not smaller than TSF time at which the STA transmits the Fine Timing Measurement frame containing this field minus 1/64 of 65536 TUs (i.e., 1024 TUs)." | FTM | REVISE. Incorporate editor instructions in submission 11-19-660. |

**Discussion:**

Other Issues:

1. subfields are referred to as fields in this clause (e.g. Partial TSF Timer is a subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element)
2. How the value of Partial TSF is derived from the TSF is embedded between how the Partial TSF Timer subfield is set in the initial Fine Timing Measurement Request frame and in the Initial Fine Timing Measurement frame
3. The description of the Partial TSF Timer subfield in the initial Fine Timing Measurement Request frame should precede the description of the corresponding subfield in the initial Fine Timing Measurement frame

Agree that the description can be improved.

The comment states, “This does not clearly reflect the intent of the statement which is to specify the allowed range of the Partial TSF Timer field value and the time at which the FTM frame containing this field is sent.”, which is incorrect. (See P1333L27-28 in D2.0 for the definition). The Partial TSF Timer subfield in the Fine Timing Parameters field in the initial Fine Timing Measurement frame from the RSTA indicates the TSF value at the RSTA at which the next FTM burst starts.

In addition, Partial TSF Timer field (subfield) does not indicate or have a relationship with when the FTM frame containing the Partial TSF Timer field is sent.

In addition the text should address the following combinations:

|  |  |  |
| --- | --- | --- |
| Frame | ASAP | Partial TSF Timer subfield value (RSTA TSF at start of FTM burst) |
| IFTMR | 0 or 1 | 0 < Partial TSF Timer subfield value <= 63487 TUs, repeats every 65535 TUs (ISTA requests the FTM Burst  to start when the TSF at the RSTA is at a value indicated by Partial TSF Timer subfield value. I.e., the ISTA can transmit a FTMR with Trigger = 1 at or after that time) |
| IFTM | 0 | 0 < Partial TSF Timer subfield value <= 63487 TUs (burst starts when the TSF at the RSTA is at a value indicated by Partial TSF Timer subfield value. I.e., the ISTA can transmit a FTMR with Trigger = 1 at or after that time) |
| IFTM | 1 | -1024 TUs <=  Partial TSF Timer subfield value  < 0 (burst has already started) |

When R0 of this submission was discussed in REVmd, there were concerns about the use of ‘as soon as possible’ and what it actually means to the protocol. The intent of ‘as soon as possible’ is that the STA is capable of starting measurements on the initial Fine Timing Measurement frame (and its acknowledgement).

Proposed Resolution: REVISE.

***Editor: Change Cl. 9.4.2.167 Fine Timing Measurement Parameters element as shown below:***

**9.4.2.167 Fine Timing Measurement Parameters element**

The Fine Timing Measurement Parameters element contains a number of subfields that are used to advertise the requested or allocated FTM configuration from one STA to another. The Fine Timing Measurement Parameters element is included in the initial Fine Timing Measurement Request frame, as described in 9.6.7.32 (Fine Timing Measurement Request frame format), and the initial Fine Timing Measurement frame, as described in 9.6.7.33 (Fine Timing Measurement frame format). The use of the Fine Timing Measurement Parameters element is described in 11.22.6 (Fine timing measurement (FTM) procedure).

The format of the Fine Timing Measurement Parameters element is shown in 9-617 (Fine Timing Measurement Parameters element format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Element ID | Length | Fine Timing Measurement Parameters  |
| Octets | 1 | 1 | 9 |

Figure 9-617—Fine Timing Measurement Parameters element format

The Element ID and Length fields are defined in 9.4.2.1 (General).

The format of the Fine Timing Measurement Parameters field is shown in 9-618 (Fine Timing Measurement Parameters field format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 B6 | B7 | B8 B11 | B12 B15 | B16 B23 | B24 B39 |
|  | Status Indication | Value | Reserved | Number of Bursts Exponent | Burst Duration | Min Delta FTM | Partial TSF Timer |
| Bits | 2 | 5 | 1 | 4 | 4 | 8 | 16 |
|  | B40 | B41 | B42 | B43 B47 | B48 B49 | B50 B55 | B56 B71 |
|  | Partial TSF Timer No Preference | ASAP Capable | ASAP | FTMs Per Burst | Reserved | Format and Bandwidth | Burst Period |
| Bits | 1 | 1 | 1 | 5 | 2 | 6 | 16 |

Figure 9-618—Fine Timing Measurement Parameters field format

The Status Indication subfield indicates the responding STA’s response to the Fine Timing Request. The encoding of the Status Indication subfield is shown in Table 9-279 (Status Indication subfield values).

Table 9-279—Status Indication subfield values

|  |  |
| --- | --- |
| **Value** | **Description** |
| 0 | Reserved |
| 1 | Successful (some requested parameters might have been overridden).Measurement exchanges are about to begin |
| 2 | Request incapable. Do not send same request again. FTM session ends. |
| 3 | Request failed. Do not send new request for Value seconds. FTM session ends. |

The Status Indication subfield and Value subfield are reserved in the initial Fine Timing Measurement Request frame. When the Status Indication subfield is set to 3 by the responding STA, the Value subfield contains a duration in units of seconds; otherwise the Value subfield is reserved.

The Number of Bursts Exponent subfield indicates how many burst instances, defined in 11.22.6.4
(Measurement exchange), are requested for the FTM session if included in an initial Fine Timing
Measurement Request frame, or allocated for the FTM session if included in an initial Fine Timing
Measurement frame respectively, where the number of burst instances is 2Number of Bursts Exponent. The value 15 in an initial Fine Timing Measurement Request frame indicates no preference by the initiating STA and is valid (indicating 215 burst instances) when set by the responding STA.

The Burst Duration subfield indicates the duration of a burst instance. The value 15 in the initial Fine Timing Measurement Request indicates no preference by the initiating STA and is not used by the responding STA. Table 9-280 (Burst Duration field encoding) shows the encoding of this subfield.

Table 9-280—Burst Duration subfield encoding

|  |  |
| --- | --- |
| **Value** | **Represents** |
| 0-1 | Reserved |
| 2 | 250 µs |
| 3 | 500 µs |
| 4 | 1 ms |
| 5 | 2 ms |
| 6 | 4 ms |
| 7 | 8 ms |
| 8 | 16 ms |
| 9 | 32 ms |
| 10 | 64 ms |
| 11 | 128 ms |
| 12-14 | Reserved |
| 15 | No Preference |

The Min Delta FTM subfield indicates the minimum time between consecutive Fine Timing Measurement frames. It is measured from the start of a Fine Timing Measurement frame to the start of following Fine Timing Measurement frame, in units of 100 µs. The value 0 indicates no preference by the initiating STA and is not used by the responding STA.

The value in the Partial TSF Timer subfield is the partial value of the responding STA’s TSF at the start of the first burst instance. The Partial TSF Timer subfield value is derived as follows, so as to have units of TUs: from the 64 TSF timer bits at the start of the first burst instance of an FTM session and remove the most significant 38 bits and the least significant 10 bits.

The initiating STA indicates a preferred time for the start of the first burst instance by setting the Partial TSF Timer No Preference subfield to 0 and by setting the Partial TSF Timer subfield to indicate the preferred start of the first burst instance, in the Fine Timing Measurement Request frame. Otherwise the Partial TSF Timer No Preference subfield is set to 1 and the Partial TSF Timer subfield is reserved. The Partial TSF Timer No Preference subfield is reserved when the Fine Timing Measurement Parameters element is included in an initial Fine Timing Measurement frame.

The value of the Partial TSF Timer subfield in an initial Fine Timing Measurement frame is the partial value of the responding STA’s TSF timer at the start of the first burst instance of an FTM session.

NOTE—1024 TUs out of the full range of the Partial TSF Timer subfield are not used in order to allow the recipient to resolve ambiguity arising from 1) imperfect synchronization between the initiating and responding STAs, and 2) retries of the initial Fine Timing Measurement Request frame or retransmissions of the initial Fine Timing Measurement frame.

The ASAP Capable subfield indicates that the responding STA is capable of capturing timestamps associated with an initial Fine Timing Measurement frame (and its acknowledgement) and sending them in the following Fine Timing Measurement frame. This subfield is reserved in the initial Fine Timing Measurement Request frame.

The ASAP subfield indicates the initiating STA’s request to start the first burst instance of the FTM session with the initial Fine Timing Measurement frame and start timestamp measurements on the initial Fine Timing Measurement (and its acknowledgement). The responding STA sets the ASAP subfield to 1 to indicate the STA’s intent to send a Fine Timing Measurement frame as soon as possible and capture timestamps corresponding to the transmission of the initial Fine Timing Measurement frame and the receipt of its acknowledgement.

When the ASAP subfield is set to 0 and the Partial TSF Timer No Preference subfield is set to 0 by an initiating STA, the initiating STA requests the start of the first burst instance specified by the Partial TSF Timer subfield in the initial Fine Timing Measurement Request frame. When the ASAP subfield is set to 1 and the Partial TSF Timer No Preference subfield is set to 0 by an initiating STA, the Partial TSF Timer subfield in the Fine Timing Measurement Request frame indicates the requested start of the first burst instance if the ASAP subfield is set to 0 in the corresponding initial Fine Timing Measurement frame. The Partial TSF Timer subfield in both these frames is set to a value between 0 and 62/64 of 65535 TUs (inclusive).

Figure 9-619 describes how the value of the Partial TSF Timer subfield is determined based on the ASAP subfield and the Partial TSF Timer No Preference subfield at an initiating STA and on the ASAP subfield at the responding STA (Calculation of the value for the Partial TSF Timer subfield).

***Editor: Note Figure 9-619 is moved from its original location to below:***



Figure 9-619—Calculation of the value for the Partial TSF Timer subfield

The ASAP subfield is also used by the responding STA to signal whether that request has been honored or not. When the ASAP subfield is set to 0 by the responding STA, the Partial TSF Timer subfield in the initial Fine Timing Measurement frame indicates the start time of the first burst instance and the earliest time the Fine Timing Measurement Request frame (see 11.22.6.4 (Measurement exchange)) should be sent by the initiating STA.

The Partial TSF Timer subfield in both these frames is set to a value between 0 and 62/64 of 65535 TUs (inclusive).

When the ASAP subfield is set to 1 by the responding STA, the Partial TSF Timer subfield in the initial Fine Timing Measurement frame indicates the start time of the first burst instance and the earliest time the initial Fine Timing Measurement frame will be sent. The value in the Partial TSF Timer subfield in this case is set to a value less than 1/64 of 65536 TUs (inclusive) (≤ 1024 TUs) from the responding STA’s TSF timer.

The FTMs Per Burst subfield indicates how many successfully transmitted Fine Timing Measurement frames are requested per burst instance by the initial Fine Timing Measurement Request frame, or allocated by the initial Fine Timing Measurement frame, respectively. The value 0 indicates no preference by the initiating STA and is not used by the responding STA.

The Format And Bandwidth subfield indicates the requested or allocated PPDU format and bandwidth that can be used by Fine Timing Measurement frames in an FTM session and is shown in Table 9-281 (Format And Bandwidth subfield). The value 0 indicates no preference by the initiating STA in the associated state and is not used by the responding STA.The value 0 is not used by the initiating STA in the unassociated state.

Table 9-281— Format And Bandwidth subfield

|  |  |  |
| --- | --- | --- |
| **Field Value** | **Format** | **Bandwidth (MHz)** |
| 0 | No preference | No preference |
| 1-3 | Reserved | Reserved |
| 4 | Non-HT | 5 |
| 5 | Reserved | Reserved |
| 6 | Non-HT | 10 |
| 7 | Reserved | Resereved |
| 8 | Non-HT, excluding Clause 15 (DSSS PHY specification for the 2.4 GHz band designated for ISM applications) and Clause 16 (High rate direct sequence spread spectrum (HR/DSSS) PHY specification) | 20 |
| 9 | HT Mixed | 20 |
| 10 | VHT | 20 |
| 11 | HT Mixed | 40 |
| 12 | VHT | 40 |
| 13 | VHT | 80 |
| 14 | VHT | 80+80 |
| 15 | VHT (two separate RF LOs) | 160 |
| 16 | VHT (single RF LO) | 160 |
| 17-30 | Reserved | Reserved |
| 31 | DMG | 2160 |
| 32-63 | Reserved | Reserved |

NOTE—See 21.3.17.3 (Transmit center frequency and symbol clock frequency tolerance) regarding the usage of two separate RF LOs.

The Burst Period subfield indicates the interval between two consecutive burst instances, in units of 100 ms. The value 0 indicates no preference by the initiating STA. This subfield is reserved when the Number of Bursts Exponent subfield is set to 0.

***Editor: Update the incorrect references to subfields (as field) in the following as shown below:***

***P2342L35-36***

This initial Fine Timing Measurement frame shall include the Fine Timing Measurement Parameters element. The value of the Status Indication subfield indicates the outcome of the request.

***P2342L44-52***

In the case of requests for 160 MHz bandwidth, the initiating STA shall indicate in the Format And Bandwidth subfield whether it uses a single or two separate RF LOs. In the cases when the responding STA indicates use of 160 MHz bandwidth, the responding STA shall indicate in the Format And Bandwidth subfield whether it uses a single or two separate RF LOs.

The initiating STA shall indicate, in the Format and Bandwidth subfield, a format and bandwidth that it supports(#1015).

***P2342L54-65***

If the request was successful
— (#1015)The responding STA shall indicate, in the Format and Bandwidth subfield, a format and bandwidth that it supports. The responding STA should indicate the same format and bandwidth in the Format and Bandwidth subfield as that requested by the initiating STA, if the responding STA supports this. The responding STA shall not indicate a bandwidth wider than requested. The responding STA shall not indicate a VHT format if DMG, HT-mixed or non-HT format was requested. (#1015)The responding STA shall not indicate an HT format if DMG or non-HT format was requested. The responding STA shall not indicate a DMG format if VHT, HT-mixed or non-HT format was requested.

***P2343***

— An initiating STA performing an FTM(#1022) procedure with a responding STA that is an AP shall support non-ASAP operation.
— A responding STA that is an AP shall support and select non-ASAP operation when so requested by an initiating STA.
— An initiating STA performing an FTM(#1022) procedure with a responding STA that is not an AP shall support ASAP operation.
— A responding STA that is not an AP shall support and select ASAP operation when so requested by an initiating STA.
— If the responding STA is ASAP capable, the responding STA’s selection of ASAP should be the same as that requested by the initiating STA.
— The responding STA’s selection of the Min Delta FTM field value shall be greater than or equal to the value requested by the initiating STA.
— The responding STA’s selection of the Number of Bursts Exponent subfield value shall be 0 if the initiating STA requested it to be 0.
— The responding STA’s selection of the Burst Duration subfield value should be less than or equal to the one requested by the initiating STA if the requested (#1426)FTMs Per Burst subfield value is set to a value indicating no preference, subject the recommendations below and the responding STA’s policy on the maximum and minimum Burst Duration subfield values.
— If the Number of Bursts Exponent subfield is set to 0 and the ASAP subfield is set to 1, the Burst Duration subfield value should be set to indicate the value *BD*1, defined as follows:

 *BD*1 = (( *NFTMPB* × (*K* + 1)) – 1) × *TMDFTM* + *TFTM* + aSIFSTime + *Tack*

 where

|  |  |
| --- | --- |
| *NFTMPB* | is the value of the (#1426)FTMs Per Burst field |
| *K*  | is the maximum number of Fine Timing Measurement frame retransmissions theresponding STA might attempt |
| *TMDFTM* | is the duration indicated by the Min Delta FTM subfield of the Fine TimingMeasurement Parameters field of the initial Fine Timing Measurement frame(FTM\_1) |
| *TFTM*  | is the duration of the initial Fine Timing Measurement frame if the (#1426)FTMsPer Burst subfield of the Fine Timing Measurement Parameters field of FTM\_1 is set to 1, and the duration of the non initial Fine Timing Measurement frame otherwise |
| *TAck*  | is the duration of the Ack frame expected as a response |

— Otherwise, the Burst Duration subfield value should be set to indicate a value greater than or equal
to the following value:

 *BD*1 + *TFTMR* + aSIFSTime + *Tack* + *TACCESS\_FTM*

where

*TFTMR* is the duration of a Fine Timing Measurement Request frame without a
Measurement Request element and without a Fine Timing Measurement
Parameters element

*TACCESS\_FTM* is the estimated medium access time for the first Fine Timing Measurement
frame(#1353) in a burst

— The responding STA’s selection of the value of the (#1426)FTMs Per Burst subfield should be the same as the one requested by the initiating STA if the requested value of the Burst Duration subfield is set to a value indicating no preference (see Table 9-280 (Burst Duration subfield encoding)), subject to the responding STA’s policy on the maximum value of the (#1426)FTMs Per Burst subfield.

***P2344L1-12***

— The responding STA’s selection of Burst Period shall be greater than or equal the responding STA’s selection of Burst Duration.

NOTE—Apart from the Status Indication, Value, ASAP, Number of Bursts Exponent, Min Delta FTM, and Burst Period subfields, the other subfields in the Fine Timing Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement frame have no constraints.

When the responding STA cannot support the initiator’s Min Delta FTM or Number of Bursts Exponent constraints, the responding STA shall set the Status Indication subfield to Request incapable and the FTM session ends. When the responding STA is unable to fulfill the request by the initiating STA, the responding STA shall set the Status Indication subfield to Request failed and the FTM session ends.

***P2344L58-62***

The first burst instance shall start at the value indicated by the value of the Partial TSF Timer subfield in the initial Fine Timing Measurement frame, regardless of the ASAP field’s value. When ASAP is set to 1 by the responding STA, the Partial TSF Timer subfield value shall be set to a value less than 10 ms from the reception of the most recent initial Fine Timing Request frame.

***P2346L1-4***

The initiating STA can request the responding STA to start the burst instances “as soon as possible” by setting the ASAP subfield to 1. The scheduling in this case is illustrated in Figure 11-35 (Example negotiation and measurement exchange sequence, ASAP=1, and FTMs Per Burst = 2(#148)(#1426)).

***P2346L59-60***

The initiating STA may also request a single burst of FTMs to be taken as soon as possible, in which case it sets the Number of Bursts Exponent subfield to 0 and the ASAP subfield to 1.

***P2347L56-65***

The ASAP Capable subfield shall be set to 1 in the initial Fine Timing Measurement frame if a responding STA is ASAP-capable; otherwise it shall be set to 0.

A responding STA transmits Fine Timing Measurement frames in overlapping pairs of consecutive frames. For example, in Figure 11-35 (Example negotiation and measurement exchange sequence, ASAP=1, and FTMs Per Burst = 2(#148)(#1426)), FTM\_1 and FTM\_2, FTM\_2 and FTM\_3, and FTM\_3 and FTM\_4 are overlapping pairs of consecutive frames. The first Fine Timing Measurement frame of a pair of consecutive Fine Timing Measurement frames contains a nonzero value in the Dialog Token subfield.

***P2348L1-29***

Timing Measurement frame contains a Follow Up Dialog Token field set to the value of the Dialog Token field in the first frame of the consecutive pair. Dialog Token field values of consecutive Fine Timing Measurement frames shall be consecutive, except when the value wraps around to 1 or in the last Fine Timing Measurement frame in an FTM session. With the first Fine Timing Measurement frame, both STAs capture timestamps. The responding STA captures the time at which the Fine Timing Measurement frame is transmitted (*t1*). The initiating STA captures the time at which the Fine Timing Measurement frame arrives (*t2*) and the time at which the Ack response is transmitted (*t3*). The responding STA captures the time at which the Ack frame arrives (*t4*). See Figure 6-17 (Fine timing measurement primitives and timestamps capture). In the follow up Fine Timing Measurement frame, in the same or the subsequent burst, the responding STA transfers the timestamp values it captured (*t1* and *t4*) to the initiating STA. In this follow up Fine Timing Measurement frame, the timestamp values (*t1* and *t4*) shall be the measurement according to the responding STA’s clock (i.e., without applying any frequency offset correction to the time bases).

NOTE—A Fine Timing Measurement frame can contain nonzero values in both the Dialog Token and Follow Up Dialog Token fields, meaning that the Action frame contains follow up information from a previous measurement, and new Timestamp values are captured to be sent in a future follow up Fine Timing Measurement frame.

When the ASAP field is set to 0 by a responding STA, the Follow Up Dialog Token, TOD, TOA, TOD Error, and TOA Error fields in the Fine Timing Measurement frame following the initial Fine Timing Measurement frame shall be reserved.

When the ASAP subfield is set to 1 by a responding STA, the timestamps for the initial Fine Timing Measurement frame shall be captured and sent in the following Fine Timing Measurement frame. In the Fine Timing Measurement frame following the initial Fine Timing Measurement frame, the TOD and TOA fields shall be set to the timestamps associated with the initial Fine Timing Measurement frame.

***P2348L64-65***

A responding STA that transmits a Fine Timing Measurement frame with the ASAP subfield set to 0 shall set the Partial TSF Timer field to an offset value *DTSF* from the partial value of the responding STA’s TSF timer

***P2349L12-13***

|  |  |
| --- | --- |
| *TMDFTM*  | is the value of the Min Delta FTM subfield of the Fine Timing Measurement Parameters field of FTM\_1. |

***P2349L20-21***

NOTE—This value of the Partial TSF Timer subfield ought to result in the Fine Timing Measurement Request frame not being transmitted before a successful transmission of FTM\_1.