IEEE P802.11
Wireless LANs

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| 802.11Changes to D1.3 for consistent use of various terms(relative to IEEE 802.11 REVmd D2.0 and P802.11az D1.2) |
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**Abstract**

This submission proposes editorial changes to D1.2 in order ensure consistent use of various terms.

History:

R0: Initial Version.

Discussion:

1. Unify measurement exchange and scheduling methods:
	1. Remove RSTA/ISTA centric terminology
	2. Unify EDCA based FTM with PEDMG Ranging and EDMG ranging
	3. Unify TB ranging with Passive TB ranging

We’re left with EDCA Based FTM which for overview goes with TB ranging meas. ex.

NTB ranging meas. ex. is stand alone in the overview.

1. RSTA Scheduled operation overview -> EDCA Based FTM and TB Ranging operation overview

integrate RSTA Passive overview 11.22.6.1.3 into that (leave content as is).

1. ISTA Centric operation overview -> Non TB Ranging operation overview

Headings structure:

1. 11.22.6.1. Overview
	1. 11.22.6.1.1 EDCA Based Ranging and Triger Based Ranging overview
	2. 11.22.6.1.2 Non Trigger ~~Based~~ Ranging overview
	3. ~~11.22.6.1.3 RSTA centric for passive ranging operation overview~~
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	1. 11.22.6.3.1 General
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	5. 11.22.6.3.5 Negotiation for Secure EDMG ~~Secure~~ TRN ~~ToF Measurement Setup~~ in EDCA based measurement exchange
	6. 11.22.6.3.6 Negotiation ~~of~~ for Direction Measurement for PDMG/PEDMG
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	2. 11.22.6.4.2 ~~RSTA Centric~~ EDCA Based Ranging measurement exchange
	3. 11.22.6.4.3 ~~Measurement Exchange in~~ TB Ranging ~~Mode~~ measurement exchange
		1. 11.22.6.4.3.1 General
		2. 11.22.6.4.3.2 Polling Phase of TB Ranging
		3. 11.22.6.4.3.3 TB Ranging Measurement Sounding Phase ~~Measurement~~ ~~Sounding Phase~~ of
		4. 11.22.6.4.3.4 TB Ranging Measurement Reporting Phase ~~of TB Ranging~~
	4. 11.22.6.4.4 ~~Measurement Phase in~~ Non-TB ~~Mode~~ ~~Based~~ Ranging Measurement exchange
		1. 11.22.6.4.4.2 Non-TB Measurement Sounding Phase
		2. 11.22.6.4.4.3 Non-TB Ranging Measurement Reporting Phase
	5. 11.22.6.4.5 Transmission of a ranging NDP
	6. 11.22.6.4.6 Secure Non-TB and TB Ranging Measurement Exchange Protocol
		1. 11.22.6.4.6.1 Secure Non-TB ranging ~~mode~~ measurement exchange
		2. 11.22.6.4.6.2 Secure TB ranging ~~mode~~ measurement exchange
		3. 11.22.6.4.6.3 Secure LTF Generation Information
	7. 11.22.6.4.6a Time of Arrival estimation using Phase Shift Feedback
	8. 11.22.6.4.7 PDMG/PEDMG measurement exchange (consider moving to subcluase of 11.22.6.4.2)
		1. 11.22.6.4.7.1 General
		2. 11.22.6.4.7.2 PDMG/PEDGM AOA/AOD measurement exchange
		3. 11.22.6.4.7.3 AOD feedback exchange after an FTM exchange
		4. 11.22.6.4.7.4 PEDMG LOS assessment for EDCA based Ranging measurement exchange ~~FTM exchange~~
		5. 11.22.6.4.7.5 First Path AWV ~~FTM~~ for EDCA based Ranging measurement exchange
	9. ~~11.22.6.4.8~~ 11.22.6.4.7.6 Secure ~~EDMG~~ Measurement Exchange for EDMG STAs  ~~Protocol~~ (consider moving as subcluase of 11.22.6.4.7)
	10. 11.22.6.4.9 Measurement Exchange in Passive Location Ranging ~~mode~~
		1. 11.22.6.4.9.1 General
		2. 11.22.6.4.9.2 ~~Passive Location Ranging~~ TB Measurement Exchange Sounding phase for Passive Location
		3. 11.22.6.4.9.3 ~~Passive Location Ranging~~ TB Measurement Exchange Reporting phase for Passive Location
	11. 11.22.6.5 Fine Timing Measurement parameter modification
		1. 11.22.6.5.1 Availability Window parameter modification
	12. 11.22.6.6 Fine timing measurement termination
		1. 11.22.6.6.1 Fine timing measurement termination for EDCA based Ranging
		2. 11.22.6.6.2 TB Ranging and non-TB Ranging session termination

Terms used:

1. FTM session is an instance of FTM procedure, a STA may have multiple concurrent instances of the FTM procedure.
2. Types of Meas. exchange:
	1. EDCA Based Ranging
	2. Trigger based ranging
		1. Passive Location Ranging
	3. NTB based ranging
3. STAs roll types in FTM operation
	1. RSTA
	2. ISTA
	3. PSTA
4. Types of STAs based on underlying PHY
	1. VHT/HT/NHT/PEDMG/PDMG STA may support -> EDCA based
	2. HE STA may support -> TB and NTB
5. FTM sessions components:
	1. Negotiation Meas.
	2. Measurement Exchange
		1. Polling phase (TB only)
		2. Sounding phase
		3. Reporting phase
	3. Termination
	4. Deprecate the use of part (it’s a duplicate of phase)
6. Deprecate the use of Mode (it’s a duplicate of meas. exchange)
7. Ranging operation (it’s a duplicate of FTM session and/or FTM procedure).

***TGaz Editor: delete the following occurrences of RSTA Centric from the draft.***

***P14L12***

**6.3.56.2.1 Function**

***Change the paragraph below:***This primitive requests the transmission of a Fine Timing Measurement frame to a peer entity to initiate the (#1238, #1241) EDCA based Ranging measurement exchange (11.22.6.4.2), or to initiate a TB (11.22.6.4.3 TB Ranging measurement exchange) or a non-TB (11.22.6.4.4 non-TB Ranging measurement exchange) Sounding Exchange with the specified peer entity.

***P15-17***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Type | Valid Range | Description | Applies to non-TB or TB Ranging? |
| Dialog Token | Integer | 0-255 | The dialog token to identify the Fine Timing Measurement frame in (#1238, #1241) EDCA based Ranging measurement exchange (11.22.6.4.2). A value of 0 indicates the end of the FTM session | No |
| Follow Up Dialog Token | Integer | 0-255 | The dialog token of a Fine Timing Measurement frame which the current frame follows, or 0 if there is no such frame. See 11.22.6.4.2 (EDCA based Ranging Measurement Exchange) | No |
| t1 | Integer | 0 - (248 – 1) | For EDCA based Ranging measurement exchange (11.22.6.4.2), the value of t1 (see Figure 6-17 (Fine timing measurement primitives and timestamps capture)) for the Fine Timing Measurement frame identified by the Follow Up Dialog Token, in units of picoseconds, or null if the Follow Up Dialog Token is 0. | No |
| Max t1 Error Exponent | Integer | 0-31 | The maximum error in the t1 value. Is represented using a function of the Max t1 Error Exponent parameter as defined in Equation (9-4), or is null if the Follow Up Dialog Token is 0. | No |
| t4 | Integer | 0 – (248 – 1) | For (#1238, #1241) EDCA based Ranging measurement exchange (11.22.6.4.2), the value of t4 (see Figure 6-17 (Fine timing measurement primitives and timestamps capture)) for the Fine Timing Measurement frame identified by the Follow Up Dialog Token, in units of picoseconds, or null if the Follow Up Dialog Token is 0. | No |

**6.3.56.2.3 When Generated
*Change the following paragraph as follows:***
This primitive is generated by the SME to request that a Fine Timing Measurement frame be sent to a peer entity in the context of an active FTM Session. If the FTM session is
—(#1238, #1241) EDCA based Ranging measurement exchange (11.22.6.4.2): the SME generates this primitive to request that a Fine Timing Measurement frame be sent to a peer entity
— Non-TB Ranging measurement exchange (11.22.6.4.4): the SME generates this primitive to request that a non-TB Ranging measurement exchange be initiated with the specified peer entity. Note that the sounding exchange initiation will be according to the MinProcessingTime and MaxToaAvailable thresholds that are defined when the corresponding FTM session was established.
— TB Ranging measurement exchange (11.22.6.4.3): the SME generates this primitive to request that a TB Ranging measurement exchange be initiated with the specified peer entity. Note that this causes the MLME to respond to the Trigger frame with type set to Location and subtype set to Polling from the specified peer entity.

**6.3.56.2.4 Effect of receipt**22 ***Change the following paragraph as follows:***
On receipt of this primitive, the MLME constructs a Fine Timing Measurement frame with the specified parameters. This frame is then scheduled for transmission.

— If there is no active FTM session with the specified peer entity, the MLME returns an error to the SME.
— If there is an active FTM session where the corresponding measurement exchange is

* (#1238, #1241) EDCA based Ranging measurement exchange (11.22.6.4.2): the MLME constructs a Fine Timing Measurement frame with the specified parameters. This frame is then scheduled for transmission.
* Non-TB Ranging measurement exchange (11.22.6.4.4): the MLME generated a Ranging NDP Announcement frame with the specified parameters and transmits it to the specified peer entity.
* TB Ranging measurement exchange (11.22.6.4.3): the MLME responds to the next Trigger frame with type set to Location and subtype set to Polling from the specified peer entity.

***P17L11-P18***

**6.3.56.3 MLME-FINETIMINGMSMT.confirm**

**6.3.56.3.1 Function**

***Insert the following paragraph at the end of the clause:***

For EDCA based Ranging measurement exchange (11.22.6.4.2), this this primitive indicates that a Fine Timing Measurement frame has been received by the peer STA to which it was sent. For TB (11.22.6.4.3 TB Ranging measurement exchange) or non-TB (11.22.6.4.4 non-TB Ranging measurement exchange) Sounding Exchange this primitive indicates that the corresponding sounding exchange completed successfully with the specified peer entity, and an RSTA to ISTA Location Measurement Report is expected imminently.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Type | Valid Range | Description | Applies to non-TB or TB Ranging? |
| Dialog Token | Integer | 0-255 | The dialog token to identify the Fine Timing Measurement frame in (#1238, #1241) EDCA based Ranging measurement exchange (11.22.6.4.2). A value of 0 indicates the end of the FTM session | No |
| t1 | Integer | 0 - (248 – 1) | For EDCA(#1238, #1241) based Ranging measurement exchange (11.22.6.4.2), the value of t1 (see Figure 6-17 (Fine timing measurement primitives and timestamps capture)) for the Fine Timing Measurement frame identified by the Dialog Token, in units of picoseconds, or null if the Dialog Token is 0. | No |
| Max t1 Error Exponent | Integer | 0-31 | The maximum error in the t1 value. Is represented using a function of the Max t1 Error Exponent parameter as defined in Equation (9-4), or is null if the Dialog Token is 0. | No |
| t4 | Integer | 0 – (248 – 1) | For (#1238, #1241) EDCA based Ranging measurement exchange (11.22.6.4.2), the value of t4 (see Figure 6-17 (Fine timing measurement primitives and timestamps capture)) for the Fine Timing Measurement frame identified by the Dialog Token, in units of picoseconds, or null if the Dialog Token is 0. | No |

**6.3.56.3.3 When generated**

***Insert the following paragraph at the end of the clause Change the paragraph as shown below:***

This primitive is generated by the MLME when

* an Ack frame corresponding to the Fine Timing Measurement frame is received from the peer STA, when the ranging protocol is (#1238, #1241)EDCA based Ranging measurement exchange (11.22.6.4.2), or
* the sounding exchange corresponding to the underlying non-TB (11.22.6.4.4) or TB (11.24.6.4.3) Ranging measurement exchange is successfully completed.

***P43L12-18***

For EDCA based ranging where the value of the corresponding Format and Bandwidth subfield is in the range 31 through 41 (inclusive), the EDMG Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement Request frame contains the ISTA’s Ranging Priority request which indicates the time sensitivity of a ranging operation, and it is set according to Table 9-281c.

For EDCA based ranging where the value of the corresponding Format and Bandwidth subfield is outside the range 31 through 41 (inclusive), the EDMG Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement Request frame is reserved.

***P43L22-26***

For EDCA based ranging where the value of the corresponding Format and Bandwidth subfield is in the range 31 through 41 (inclusive), the EDMG Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement frame contains the RSTA’s Ranging Priority response which indicates whether the RSTA accommodates the Ranging Priority request of the ISTA, and it is set according to Table 9-281d.

***P44L5-7***

For an EDCA based ranging session where the value of the corresponding Format and Bandwidth subfield is outside the range 31 through 41 (inclusive), the EDMG Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement frame is reserved.

***P69L20-25***

**(#2091)** If the initiator requests negotiation of parameters with the responder in order to perform Fine Timing Measurement as the ranging protocol as defined in 11.22.6.4.2 (EDCA based Ranging measurement exchange, the Fine Timing Measurement Parameters field is present in the initial Fine Timing Measurement Request frame (see 11.24.6.3 (Fine timing measurement procedure negotiation)) and its retransmissions and is not present in subsequent Fine Timing Measurement Request frames. If present, it contains a Fine Timing Measurement Parameters element as defined in 9.4.2.168 (Fine Timing Measurement Parameters element).

***P70L6-24***

The FTM Measurement Synchronization Information field is present in the initial Fine Timing Measurement frame and its retransmissions if any, and in the first Fine Timing Measurement frame within each burst and its retransmissions if any; if the responder selects Fine Timing Measurement (11.22.6.4.2 EDCA based FTM measurement exchange) for the ranging phase, and in an A-MPDU aggregated with an LMR frame if the responder selects TB Ranging for the ranging phase; otherwise it is not present. If present, and the selected ranging phase is Fine Timing Measurement (11.22.6.4.2 EDCA based FTM measurement exchange), the FTM Synchronization Information field contains an FTM Synchronization Information element with a TSF Sync Info field containing the 4 least significant octets of the TSF at the responding STA corresponding to the time the responding STA received the last Fine Timing Measurement Request frame with the Trigger field equal to 1.

**(#2091)** If the initiator requested negotiation of parameters with the responder in order to perform Fine Timing Measurement as the ranging protocol as defined in 11.22.6.4.2 (EDCA based Ranging measurement exchange), the Fine Timing Measurement Parameters field is present in the initial Fine Timing Measurement Frame (see 11.22.6.3 (Fine timing measurement procedure negotiation)) and its retransmissions, and is not present in subsequent Fine Timing Measurement frames except for the conditions described in subclauses 11.22.6.5 and 11.22.6.6. If present, it contains a Fine Timing Measurement Parameters element as defined in 9.4.2.279 (Ranging Parameters)

***P82L33-35, P83L1-14***

Since some of the initiating STA’s activities may be nondeterministic and might have higher precedence than the FTM session (e.g., data transfer interaction with an associated AP), a conflict might prevent the initiating STA from being available at the scheduled time window(s) for executing the ranging measurement exchange(s). The FTM procedure provides mechanisms as described in 11.22.6.1.1 (EDCA based Ranging and Trigger based Ranging overview) and 11.22.6.1.2 (non-Trigger based Ranging overview) to ensure that the ISTA is available to execute the ranging measurement exchange as scheduled.

***TGaz Editor: Rename Cl. 11.22.6.1.1 from “RSTA scheduled operation overview” to “EDCA based Ranging and Trigger based Ranging overview”***

***TGaz Editor: Rename Cl. 11.22.6.1.2 from “ISTA centric operation overview” to “non- Trigger based Ranging overview”***

***TGaz Editor: Rename Cl. 11.22.6.3.2 from “EDCA-based ranging session negotiation” to “Negotiation for EDCA based ranging measurement exchange”***

***P88L9-26***

— The responding STA shall indicate, in the Format and Bandwidth field, a format and bandwidth that it supports. The responding STA should indicate the same format and bandwidth in the Format and Bandwidth field 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. The responding STA shall not indicate an HTformat 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. For EDCA based ranging where the value of the corresponding Format and Bandwidth subfield is in the range 31 through 41 (inclusive), the ISTA shall indicate, in the Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement Request frame, its ranging priority according to Table x1 in 9.4.2.167. The RSTA shall indicate, in the Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement frame, whether it accommodates the Ranging Priority request transmitted by the ISTA according to Table 9-281b in 9.4.2.167. For EDCA based ranging where the value of the corresponding Format and Bandwidth subfield is outside the range 31 through 41 (inclusive), the Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element is reserved.

***TGaz Editor: Delete P90L12-18 (The content is already part of the paragraph above).***

If a Fine Timing Measurement Parameters field is included in the initial Fine Timing Measurement frame where the Format and Bandwidth subfield is in the range 31 through 41 (inclusive), the Fine Timing Measurement Parameters element shall contain either a PDMG Specific Parameter subelement or a PEDMG Specific Parameters subelement.

***TGaz Editor: Rename Cl. 11.22.6.3.3 from “Trigger-based and non-Trigger-based Ranging Measurement Negotiation” to “Negotiation for Trigger based and non-Trigger based Ranging measurement exchange”***

***P92L4-6***

In the former case, the ISTA may either proceed with measurement exchange (see 11.22.6.4.3 (TB Ranging measurement exchange) and 11.22.6.4.4 (non-TB Ranging measurement exchange)) or terminate the FTM session (see 11.22.6.6 (Fine timing measurement termination)).

***TGaz Editor: Rename Cl. 11.22.6.3.4 from “Secure LTF measurement setup” to “Negotiation for Secure LTF in the Trigger based and non-Trigger based Ranging measurement exchange”***

***P93L42***

subclause 11.22.6.4.6 (Secure non-TB and TB Ranging Measurement Exchange Protocol).

***TGaz Editor: Rename Cl. 11.22.6.3.5 from “EDMG Secure ToF Measurement Setup” to “Negotiation for Secure EDMG TRN in EDCA based Ranging measurement exchange”***

***P95L10-12***

A STA that supports secure ToF measurement as described in 11.22.6.4.7.6 (Secure Measurement Exchange for EDMG STAs) shall set the Secure ToF Supported field in the EDMG capabilities element to 1.

***TGaz Editor: Rename Cl. 11.22.6.3.6 from “Negotiation of Direction Measurement for PDMG/PEDMG” to “Negotiation for direction measurement in PDMG/PEDMG”***

***TGaz Editor: Rename Cl. 11.22.6.3.7 from “PEDMG LOS Assessment negotiation” to “Negotiation LoS assessment in PEDMG”***

***P97L5-13***

**11.22.6.4 Measurement exchange**

 ***Insert the following subclauses in 11.22.6.4 as shown below:***

**11.22.6.4.1 FTM Measurement exchange overview**

FTM measurement has three basic rangingmechanisms:

— EDCA based Ranging described in clause 11.22.6.4.2

— Trigger based Ranging described in clauses 11.22.6.4.3 and 11.22.6.4.8

— non-Trigger based Ranging described in clause 11.22.6.4.4

I.

***TGaz Editor: Change the title of Cl. 11.22.6.4.2 from “RSTA Centric EDCA measurement exchange” to “EDCA based ranging measurement exchange”***

***TGaz Editor: Change the title of Cl. 11.22.6.4.3 from “Measurement Exchange in TB Ranging Mode” to “TB Ranging measurement exchange”***

**11.22.6.4.3.1 General**

TB Ranging is the dynamic trigger-based variant of the FTM procedure. The TB Ranging measurement exchange consists of one or more scheduled availability windows. The TB Ranging measurement exchange is dynamic, as the actual number of ISTAs participating in the measurement exchange can vary across availability windows. This is true since each ISTA that is polled by the RSTA in the scheduled availability window can dynamically decide it participates in the corresponding measurement exchange or not.

The availability windows are scheduled periodic time windows assigned to ISTAs during negotiation (see 11.22.6.3.3 Negotiation for Trigger based measurement exchange). Within each availability window the RSTA and ISTAs shall only perform ranging activities related to polling, measurement sounding and measurement reporting, as well as signaling of modification of availability window parameters (see 11.22.6.5.2 Availability window parameter modification). Each availability window by default consists of a single TXOP and can be extended to multiple TXOPs by announcement if a single TXOP is insufficient to accommodate all ISTAs that responded to the poll (see 11.22.6.4.3.2 Polling phase of TB Ranging and 11.22.6.4.3.3 TB ranging measurement sounding phase).

Each availability window of the TB Ranging measurement exchange consists of one or more triplets of sequential phases: polling phase, measurement sounding phase and measurement reporting phase. Figure 11-36a shows an example of two availability windows, each composed of a single triplet of polling, measurement sounding and measurement reporting phases. An RSTA and ISTA participating in TB Ranging shall perform any measurement sounding and measurement results reporting activities only within the availability windows.

***TGaz Editor: Replace all occurrences of ‘part’ with ‘phase’ in Figures 11-36a, 11-36b, 11-36c, 11-36d, 11-36e, 11-36h, 11-36i and 11-36m***

***P98L8-23***

Each availability window nominally contains a single poll, which should poll all ISTAs assigned to the availability window. If the available bandwidth is insufficient to allow for the polling of all ISTAs assigned to the availability window with one poll, the RSTA shall indicate that one or more extra polling/sounding/reporting triplets can be expected within the availability window (see example in Figure 11-36b and Figure 11-36c). All instances of polling/sounding/reporting triplets must be completed before the end of the availability window.

During the availability window, measurement resources and results are made available to each ISTA whose poll response was received at the RSTA. This may also lead to extra instances of polling/sounding/reporting triplets, even if all ISTAs assigned to this availability window were polled in the first polling phase instance (e.g., if the RSTA is not able to accommodate all ISTAs that responded in a single measurement sounding phase instance; 11.22.6.4.3.3 TB ranging measurement sounding phase).

Within each availability window, an RSTA shall use an AID or Ranging ID (RID) to identify an associated or unassociated ISTA respectively. The AID and RID assignment shall be non-conflicting and shall have the same size and valid address space (as defined in 9.4.1.8 and 22 27.16.3). The RID usage shall follow the same rules as that of AIDs for HE operations. The RIDs are assigned to unassociated ISTAs during the FTM negotiation (see 11.22.6.3 Fine timing measurement procedure negotiation).

***P99L3-5***

An ISTA shall follow the usual rules defined in subclause 27.5.3 (UL MU Operation) when transmitting any HE TB PPDUs for TB Ranging with the exceptions defined in 11.22.6.4.3 (TB ranging measurement exchange) and 11.22.6.4.4 (non-TB ranging measurement exchange).

**11.22.6.4.3.4 TB Ranging Measurement Reporting Phase**

The last phase of each polling/sounding/reporting triplet is the measurement reporting phase, which is transmitted a SIFS time after the measurement sounding phase (see Figure 11-36c). The measurement results shall be carried in LMR frames (see subclause 9.6.7.37 Location Measurement Report frame format). LMR frames shall carry measurement results from the RSTA to the ISTA, and if negotiated also from the ISTA to the RSTA (see Figure 11-36g). The feedback type of the ISTA2RSTA and RST2ISTA LMRs shall be either immediate (i.e. from the current availability window) or delayed (i.e., from the last availability window in which the ISTA responded to the TF Ranging Poll and the RSTA allocated resources to that ISTA during the measurement sounding phase). The LMR feedback (immediate/delayed) is indicated by the RSTA during the negotiation phase (see subclause 11.22.6.3.3 Negotiation for Trigger based on non-Trigger based ranging measurement exchange).

The Dialog Token field in the LMR frames shall be copied from the Sounding Dialog Token field in the corresponding Ranging NDP Announcement frame from the corresponding Measurement Sounding phase when the reported ToA and ToD values were measured (see 11.22.6.4.3.3 TB ranging measurement sounding phase (#1474))

***TGaz Editor: Change the title of Cl. 11.22.6.4.4 from “Measurement Exchange in non-TB Mode” to “non-TB Ranging measurement exchange”***

***P106L15-16***

For immediate feedback the LMR carries measurement results of this round, while for delayed feedback the LMR carries measurement results of the previous round (see 11.22.6.4.4.3 Non-TB Ranging Measurement Reporting Phase).

**11.22.6.4.5 Transmission of a ranging NDP**

***P112L16-22***

— In the secure variant non-TB and TB ranging measurement exchange, the LTF\_SEQUENCE parameter is set to as defined in 11.22.6.4.6.1 (Secure non-TB ranging measurement exchange) and 11.22.6.4.6.2 (Secure TB ranging measurment exchange). Otherwise, the LTF\_SEQUENCE parameter is not present.
— In the secure variant TB ranging measurement exchange, the LTF\_OFFSET parameter is set to as defined in 11.22.6.4.6.2 (Secure TB ranging measurement exchange). Otherwise, the LTF\_OFFSET parameter is not present.

***P113L8-10***

— In the secure variant of the non-TB ranging measurement exchange, the LTF\_SEQUENCE parameter is set to as defined in 11.22.6.4.6.1 (Secure non-TB ranging measurement exchange). Otherwise, the LTF\_SEQUENCE parameter is not present.

***P113L31-33***

— In the secure variant of the TB ranging measurement exchange, the LTF\_SEQUENCE parameter is set to as defined in 11.22.6.4.6.2 (Secure TB ranging measurement exchange). Otherwise, the LTF\_SEQUENCE parameter is not present.

***P117L8-10***

**11.22.6.4.6.2 Secure TB ranging measurement exchange**

When an RSTA has established the secure LTF measurement setup with an ISTA as specified in 11.22.6.3.4 (negotiation for secure LTF in the TB and NTB measurement exchange), the RSTA that sends a Ranging Secure Sounding Trigger frame to the STA shall set: **(#1260)**

***TGaz Editor: Renumber Cl. 11.22.6.4.6a as shown below***

**11.22.6.4.7 Time of Arrival estimation using Phase Shift Feedback**

***TGaz Editor: Move 11.22.6.4.7 PDMG/PEDMG Measurement Exchange to 11.22.6.4.2.1 PDMG/PEDMG Measurement Exchange (and renumber subclauses accordingly)***

***TGaz Editor: Fix clause numbers to match the move of PDMG/PEDMG to 11.22.6.4.2.1 and change references as shown below:***

**11.22.6.4.2.1.1 General**

(#2381) An PEDMG ISTA and RSTA that have both indicated support for first path beam forming by setting to one the First Path Training Supported field in the Beamforming Capability subelement of the EDMG Capability element, shall perform first path beamforming training as defined in 10.43.10.6 First path beamforming training.

A PDMG/PEDMG ISTA/RSTA performs an FTM exchange that does not require AOA or AOD measurements as defined in 11.22.6.4.1 (EDCA based ranging measurement exchange). To perform an FTM exchange that does require AOD or AOD measurements, it follows the procedure in 11.22.6.4.2.1.2 (PDMG/PEDMG AOA/AOD measurement exchange). In both these cases, when the first path AWV setting is not used in the exchange, the trigger field shall be set to 1 in the Fine timing Measurement Request that initiates the exchange. In both cases the same AWV used for data transfer between the devices shall be used for transmission and reception of the preamble and data portion of the PPDUs.. **(#1442, 2345, 2346)**

**11.22.6.4.2.1.2 PDMG/PEDGM AOA/AOD measurement exchange**

In a PDMG/PEDMG ISTA/RSTA pair that has agreed on performing direction measurement by agreeing on either R2I AOA, I2R AOD, I2R AOA or R2I AOD shall add TRN fields to FTM exchanges in the burst according to the Direction Measurement Density sent by the RSTA in the initial Fine Timing Measurement frame.

A PDMG/PEDMG ISTA/RSTA pair that has agreed on either R2I AOA, I2R AOD, I2R AOA or R2I AOD using the procedure described in 11.22.6.3.6 (Negotiation for direction measurement for PDMG/PEDMG) shall be denoted as Direction Measurement FTM pair.

**11.22.6.4.2.1.3 AOD feedback exchange after an FTM exchange**

When an ISTA and RSTA agreed on performing an R2I AOD measurement FTM exchange as described in 11.22.6.4.2 (EDCA based ranging measurement exchange) the ISTA needs to send AOD measurement results to the RSTA, so that the RSTA may use these to generate the AOD estimates and send the results back to the ISTA.

**11.22.6.4.2.1.4 PEDMG LOS assessment for EDCA based ranging measurement exchange**

A LOS assessment FTM exchange may provide an ISTA with information about whether the link with the ISTA is over a non-LOS path. A LOS assessment FTM exchange is a PEDMG FTM burst as defined in 11.22.6.4.2.1.1 (General) or 11.22.6.4.2.1.2 (PDMG/PEDGM AOA/AOD measurement exchange) in which one FTM frame from the RSTA to the ISTA is a LOS assessment FTM PPDU. A LOS assessment FTM burst over the regular AWV is identified by the RSTA setting the FTM trigger to 3 at the FTM request. A LOS assessment FTM burst over the first path AWV is identified by setting the FTM trigger to 4.

**11.22.6.4.2.1.5 First Path AWV for EDCA based ranging measurement exchange**

The setting of TXVECTOR when the frames are used for AOA and AOD estimation is described in 11.2.6.7.4.2.

**11.22.6.4.2.1.6 Secure measurement exchange for EDMG STAs**

The Secure EDMG Measurement exchange protocol shall be used as described 11.22.6.3.5 (Negotiation of secire EDMG TRN in EDCA based measurement exchange.) The Secure EDMG Measurement exchange protocol follows the procedure as described in 11.22.6.4.2 (EDCA based ranging measurement exchange) with the following changes:

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For an EDCA based ranging session where the value of the corresponding Format and Bandwidth subfield is outside the range 31 through 41 (inclusive), the Ranging Priority subfield of the Fine Timing Measurement Parameters field of the Fine Timing Measurement Parameters element in the initial Fine Timing Measurement Request frame or the initial Fine Timing Measurement frame is reserved. If an RSTA does not perform FTM retransmission, the maximum number of Fine Timing Measurement frame retransmissions the RSTA might attempt to zero, the RSTA shall send a new Fine Timing Measurement frame (with ToA=0, ToD=0, updated Dialog Token) with new Secure TRN (associated with the updated dialog token) appended.

***TGaz Editor: Change the title and numbering of Cl. 11.22.6.4.9 from “Measurement Exchange in Passive Location Ranging Mode” to “11.22.6.4.8 Measurement exchange in Passive Location Ranging”***

**11.22.6.4.8 Measurement exchange in passive location ranging**

**11.22.6.4.8.1 General**

***Modify the second paragraph in Cl. 11.22.6.4.8.1 as shown below:***

If an ISTA whose dot11PassiveLocationRangingInitiatorActivated is set to true, while an RSTA whose dot11PassiveLocationRangingResponderActivated is also set to true, the ISTA may activate passive location ranging exchanges. In this case, the ISTA and RSTA follow the rules described in subclause 11.22.6.4.3 (TB ranging measurement exchange in TB Mode) with the exceptions described in subclause 11.22.6.4.8 (Measurement exchange in TB passive location ranging), with subclauses.

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* The RSTA sends the Passive Location Subvariant Ranging Trigger frame instead of the TB Sounding Subvariant Ranging Trigger frame. Upon receiving of the Passive Location Subvariant Ranging Trigger frame, the ISTA responds with an HE Ranging NDP instead of an HE TB Ranging NDP. See 11.22.6.4.8.2 (TB measurement exchange sounding phase for passive location) for further details.
* The RSTA broadcasts two RSTA Broadcast Passive Location Measurement Report frames contain measurement data and related information. See 11.22.6.4.8.3 (TB measurement exchange reporting phase for passive location) for further details.

**11.22.6.4.8.2 TB measurement exchange sounding phase for passive location**

**11.22.6.4.8.3 TB measurement exchange reporting phase for passive location**

***P135L4-12***

During an FTM session, an initiating STA may terminate the current session and request a new session with modified session parameters by transmitting a Fine Timing Measurement Request frame with Trigger field set to one and including a new Fine Timing Measurement Parameters element if the corresponding FTM session is based on a Fine Timing Measurenent ranging phase (11.22.6.4.2 EDCA Ranging measurement exchange), or Ranging Parameters element if the corresponding FTM session is based on non-TB ranging (11.22.6.4.4 non-TB Ranging measurement exchange) or TB ranging (11.22.6.4.3 TB Ranging measurement exchange) Note that this allows up to one ranging session between a given ISTA and RSTA at any time **(#1566)**

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— At any time during the session the initiating STA terminates the current session and requests a new session with modified ranging parameters (see 11.22.6.5 Fine timing measurement parameter modification).