### **IEEE P802.11 Wireless LANs**

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| Transmit Power Element for FTM procedure | | | | |
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| Author(s): | | | | |
| Name | Affiliation | Address | Phone | Email |
| Jonathan Segev | Intel corporation |  |  | [Jonathan.segev@intel.com](mailto:Jonathan.segev@intel.com) |
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**Abstract**

Close to completion of IEEE 802.11bk lacking Transmit Power Envelope behavior was identified, and some modifications were made to allow an RSTA to transmit TPE, however in some usage models the ISTA is the channel anchor. This submission closes this gap as well as enable the RSTA and ISTA agreement on availability windows in NTB measurement exchange where the RSTA is a non-AP STA.

**Revisions:**

* Rev 00 - Initial version of the document.
* Rev 10 - Incorporating feedback.

***TGme editor:***

***Please note Baseline are based on REVmf D1.0 and 802.11-2025.***

***Edits are expressed via Word track changes.***

***CIDs***

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** |
| 6 | 1421 | 9.4.2.160 | The ranging mechanism using TPE does not support cases where the channel anchor is the ISTA. | Enable FTM Request frames and I2R LMR frames to carry the Transmit Power Envelope element. |
| 40 | 2984 | 11.21.6.4.4 | In FTM NTB operation, the RSTA is required to be available at all times on channel for an incoming Ranging NDPA. This is a very hard to meet requirement which doesnt exists in all other FTM modes (EDCA, TB). | Enable a similar mechanism to that of TB operation that uses "TWT" like availability windowing for measurement exchange. |

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| **REVmf editor, make changes identified below to REVmf P802.11 D1.0 as shown below:**  9.6.7.49 Location Measurement Report (LMR) frame format  In IEEE 802.11-2024 p.1708, REVmf editor change figure 9-1238 TOA Error field format as shown below:   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | B0 B4 | B5 | B6 | B7 | |  | Max TOD Error Exponent | NNW | Reserved | TOD not continuous | | Bits: | 5 | 1 | 1 | 1 |   **Figure 9-1223 – TOA Error field format**  The maximum errors in the TOD and TOA values are represented using the function defined in Equation (9-  15).    (9-15)  where  *F* is the Max Error Exponent  *Emax* is the maximum TOD or TOA error, respectively, in units of picoseconds  The Max TOD Error Exponent subfield contains an upper bound for the error exponent in the value  specified in the TOD field.  The TOD Not Continuous subfield indicates that the TOD value is with respect to a different underlying  time base than the last transmitted TOD value. It is set to 1 when a discontinuity is present. Otherwise, it is  set to 0.  The NNW field is used when the RSTA and ISTA are non-AP STAs, and set to 0 for other cases. It is set to 0 to indicate the next availability window (AW) is a range measurement window where both ISTA and RSTA are available to the duration of the currently negotiated AW.  The NNW field is set to 1 to indicate the ISTA and RSTA shall be available at the start of next availability window to complete FTM session modification and execution of a single measurement.  11.21.6.4.4 Non-TB ranging measurement exchange  **REVmf editor, insert a new clause to REVmf D1.0 at the end 11.21.6.4.4 as shown below:**  11.21.6.4.4.4 Operation with non-AP RSTA  When an FTM session is negotiated between two non-AP STAs, the ISTA and RSTA may negotiate for mutual availability of the medium. The ISTA and RSTA negotiation includes three parameters; Nominal Time, Meas Per AW and AW Duration. The negotiation and frame format for signaling between non-AP STAs of the Nominal Time, Meas Per AW and AW Duration parameters are outside the scope of this standard and may use vendor specific elements.  Availability windows are defined by Nominal Time and AW Duration that coordinate the start time and duration of the availability windows. Meas Per AW is the negotiated number of successful measurements attempts per AW.  During availability windows the ISTA and RSTA devices shall be available to exchange N successful FTM measurements instances where N equals the negotiated Meas Per AW.  Once FTM negotiation is complete, the non-AP STA shall continue channel presence till completion of the first successful measurement instance, which sets the beginning of the first AW, and nominal time after, the scheduling of the second AW. The STAs will perform Meas Per AW successful measurement inclusive of the first successful measurement during this first AW (see figure 11-XYZ0 First Availability Window In Non-AP STAs FTM Exchange).    Figure 11 – XYZ0 First Availability Window In Non-AP STAs FTM Exchange  Figure 11-XYZ1 shows three consecutive AW instances (i.e. AWs(n), AW(n+1) and AW(n+2)). AW(n+1) shows two successful measurement instances. The start time of AW(n+2) is Nominal Time from 1st successful measurement of AW(n) which happened to occur in the middle of AW(n+1). Within each AW one or more non-TB measurement sequences occur.    Figure 11-XYZ1 Example of FTM measurement instances executed in steady state Availability Windows  During AWs the ISTA and RSTA devices shall be available to exchange M successful FTM measurements instances, where M equals the negotiated Meas Per AW.  Each AW starts with the first successful measurement of the associated AW and ends AW Duration later. |
| **REVmf editor, insert a new clause to REVmf D1.0 at the end 11.21.6.4.4 as shown below:**  11.21.6.5.2 Non-TB Ranging Parameter modification with non-AP RSTA  When an FTM session is negotiated between two non-AP STAs, the ISTA and RSTA may modify the schedule during which measurement frames may be exchanged to adapt the range refresh rate to the upper layer’s time specific requirements. Both ISTA and RSTA may initiate changes to the FTM session including the AWs using FTM parameter modification. An ISTA and/or RSTA may trigger FTM parameter modification by setting the NNW field in their respective LMR’s TOD Error field to True on all measurement instances during a specific AW. If no successful measurements occur during instance n of the AW, then AW n+1 shall refer to the start of the AW n scheduling.  Upon successful measurement instance with the NNW field set to True(refer to AW(n) in figure below), the STAs shall continuously be available on channel starting nominal time away from this first successful measurement. The ISTA and RSTA shall then execute FTM session negotiation as defined in 11.21.6.5 FTM parameter modification. The ISTA and RSTA will continue channel presence untill completion of the FTM negotiation and completion of the first successful measurement instance, which sets the beginning of the first availability window in the modified session, and nominal time after, the scheduling second availability window in the modified session. The STAs will perform Meas Per AW measurements inclusive of the first successful measurement during this first modified AW.    Figure 11-XYZ2 Example of Timing of Availability Window Modification  Figure 11-XYZ2 shows an example of an FTM session where the R2I LMR and/or I2R LMR in the Nth availability window the NNW field was set to True. |
| **REVmf editor, insert a new subclause 11.21.6.3.4 between the existing 11.21.6.3.3 and 11.21.6.3.4 as shown below and make the following changes to 11.21.6.3.3:**  An unassociated ISTA that is capable of receiving a Transmit Power Envelope element as part of its FTM procedure shall set its TPE Update Capable subfield in the IFTMR frame to 1. An RSTA that is capable of transmitting a Transmit Power Envelope element as part of the FTM procedure shall respond with an IFTM frame with the TPE Update Capable field set to 1, if the IFTMR frame included a TPE Update Capable subfield set to 1.  An associated ISTA shall set the TPE Update Capable subfield to 0.  An RSTA that set the TPE Update Capable subfield to 1, shall include at least one Transmit Power Envelope element in the IFTM frame, and all LMR frames of the FTM session. When one or more Transmit Power Envelope element is included in the IFTM or LMR frames, the Transmit Power Envelope elements shall be the same as the ones carried in the Beacon and other management frames transmitted by the RSTA.  **REVmf editor, insert a new clause 11.21.6.3.4 between the existing 11.21.6.3.3 11.21.6.3.4 as shown below:**  11.21.6.3.4 Non-TB Ranging Negotiation with non-AP RSTA  An unassociated ISTA that is capable of transmitting a Transmit Power Envelope element as part of an FTM procedure, shall set its TPE Update capable subfield in the IFTMR to 1. If the TPE Update Capable subfield in the IFTMR is set to 1 and the RSTA is capable of receiving a Transmit Power Envelope element as part of the FTM procedure, it shall respond with an IFTM frame with the TPE Update Capable field set to 1 and set to 0 otherwise.  An associated ISTA shall set the TPE Update Capable subfield to 0.  An ISTA that received an IFTM with TPE Update Capable subfield set to 1 shall include at least one Transmit Power Envelope element in the IFTMR frame.  An ISTA that received an IFTM frame with a TPE Update Capable subfield to 1, shall include at least one Transmit Power Envelope element in each I2R LMR frame.  When one or more Transmit Power Envelope element is included in the IFTMR or I2R LMR frames, the Transmit Power Envelope elements shall be the same as the ones carried in the Beacon and other management frames transmitted by the ISTA. |