IEEE P802.11  
Wireless LANs

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| **PDT for LMR** | | | | |
| **Date:** 2023-07-11 | | | | |
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Abstract

We propose the draft specification skeleton for TB ranging to help the creation of TGbk draft.

Revisions:

* Rev 0: Initial version of the document.

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbk Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbk Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGbk Editor: Editing instructions preceded by “TGbk Editor” are instructions to the TGbk editor to modify existing material in the TGbk draft. As a result of adopting the changes, the TGbk editor will execute the instructions rather than copy them to the TGbk Draft.***

**Discussion:**

The text is prepared for the following motion passed on July 11th that simplify the PPDU format selection for LMR associated with an 11bk TB ranging measurement with 320 MHz EHT TB Ranging PPDU to use EHT PPDU format only.

**Proposed spec text:**

***TGbk editor: Please note Baseline is 11bkD0.1, REVme\_D3.0, IEEE 802.11az-2022, IEEE 802.11be D3.2.***

***TGbk editor: Please update 11.21.6.4 as follows (track changes enabled):***

**11.21.6.4 Measurement exchange**

**11.21.6.4.3.3 Measurement sounding phase of TB ranging**

… …

The RSTA shall select a bandwidth value for the measurement sounding phase that is less than or equal to the RSTA Assigned Max Bandwidth of each of the ISTAs that are being allocated resources during this measurement instance. It may be different from the bandwidth used in the Polling phase, but shall adhere to the rules of multiple frame transmission in an EDCA TXOP; see 10.23.2.8 (Multiple frame transmission in an EDCA TXOP).

If the selected bandwidth value is 320 MHz in a measurement sounding phase, all the TF Ranging Sounding in this measurement sounding phase shall solicit an EHT TB Ranging NDP. Otherwise, the TF Ranging Sounding shall solicit an HE TB Ranging NDP.

… …

**11.21.6.4.3.4 Reporting phase of TB ranging measurement**

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 [[11-37c](#F11o37c)](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#F11o36c) (TB ranging availability window with two instances of polling/sounding/reporting triplets in separate TXOPs). The measurement results shall be carried in LMR frames; see [9.6.7.49](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H09o6o7o49) (LMR 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 [11-37h](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#F11o37h) (TB ranging measurement reporting phase with Bidirectional LMR Feedback for n ISTAs). If the Range Reporting is performed in the context of a Secure FTM Session, see [11.21.6.3](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H11o21o6o3) (FTM procedure negotiation), the corresponding LMR and FTM; see [11.21.6.5.1](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H11o21o6o5o1) (Availability Window parameter modification); frames shall be transmitted using Protected Fine Timing Action frames, and see [9.6.34](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H09o6o34) (Protected Fine Timing Frame details).

The feedback type of the I2R and R2I LMRs may 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 frame 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 (see [11.21.6.3.3](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H11o21o6o3o3) Negotiation for TB and Non-TB ranging measurement exchange).

The Dialog Token field in the LMR frame shall be identical to the Sounding Dialog Token field in the corresponding Ranging NDP Announcement frame in the Measurement Sounding phase from which the reported TOA and TOD values were measured; see [11.21.6.4.3.3](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H11o21o6o4o3o3) (Measurement sounding phase of TB ranging).

NOTE—LMR feedback is carried in Action No-Ack frames and is therefore neither acknowledged nor retransmitted; see [[9.6.7.49](#H09o6o7o49)](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H09o6o7o48) (Location Measurement Report (LMR) frame format).

The RSTA shall transmit an R2I LMR to all ISTAs that were allocated resources in the preceding measurement sounding phase. All the R2I LMR frames shall be carried in one HE MU PPDU or one EHT MU PPDU, where each RU contains only one user. If there is only one R2I LMR it may be carried instead in an HE SU PPDU. If the bandwidth selected in the measurement sounding phase is 320 MHz and the TF Ranging Sounding frame(s) solicit EHT TB Ranging NDP(s), the corresponding R2I LMR shall be transmitted in an EHT MU PPDU. Otherwise, the R2I LMR shall be transmitted in an HE MU PPDU or an HE SU PPDU.

NOTE--if there is only one R2I LMR, the frame is carried in an HE SU PPDU, HE MU PPDU or EHT MU PPDU (including EHT SU transmission) and this does not include VHT/HT/non-HT PPDUs.

If I2R LMR was negotiated, the RSTA shall assign uplink resources to the ISTAs using a Report Ranging Trigger frame; see [9.3.1.22.10](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H09o3o1o22o10) (Ranging Trigger variant). The Ranging variant Trigger frame of report subvariant is called the TF Ranging LMR.

If the bandwidth selected in the measurement sounding phase is 320 MHz and the TF Ranging Sounding frame(s) solicit EHT TB Ranging NDP(s), the corresponding TF Ranging LMR shall solicit EHT TB PPDU. Otherwise, the TF Ranging LMR shall solicit HE TB PPDU.

A TB ranging measurement reporting phase including the optional I2R LMR is illustrated in Figure [11-37h](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#F11o37h) (TB ranging measurement reporting phase with Bidirectional LMR Feedback for n ISTAs). If the I2R LMR was negotiated by one or more ISTAs, then SIFS time after transmitting out the R2I LMR, the RSTA transmits a TF Ranging LMR to solicit the I2R LMR frame(s). This TF shall allocate uplink resources to ISTAs that negotiated I2R LMR and were allocated resources in the preceding measurement sounding phase. The RSTA shall allocate each RU in the TF Ranging LMR to only one ISTA. In response to the TF Ranging LMR, each addressed ISTA shall respond by transmitting an I2R LMR frame.

If an ISTA negotiated delayed I2R LMR reporting, and if the TOA measurement for the previous availability window is not ready, then the ISTA shall not respond to the TF Ranging Poll frame in the Polling phase of any availability window until the I2R LMR is ready.

For delayed reporting, the first instance of the R2I LMR and the optional I2R LMR do not have valid TOA/TOD timestamps to include, in this case the RSTA and the ISTA shall set the Invalid Measurement subfield in the TOA Error field of the respective LMR to 1.



**Figure 11-37h—TB ranging measurement reporting phase with bidirectional LMR feedback for n ISTAs**

In TB ranging, the PHY shall issue the PHY-RXEND.indication primitive with error condition IntegrityCheckError, if the PHY detects the integrity check error in the reception of the corresponding HE Ranging NDP or HE TB Ranging NDP. If the PHY of an RSTA issues a PHY-RXEND.indication primitive with error condition IntegrityCheckError, the RSTA shall set the Invalid Measurement field in the R2I LMR frame carrying the TOA measured from the I2R NDP to 1. Correspondingly, if I2R LMR was negotiated between the ISTA and RSTA and the PHY of the ISTA issues a PHY-RXEND.indication primitive with error condition IntegrityCheckError, the ISTA shall set the Invalid Measurement field in the I2R LMR carrying the TOA measured from the R2I NDP to 1.

NOTE—When a STA detects that the transmit center frequency offset (CFO) between the ISTA and the RSTA exceeds the allowed tolerance from the values specified in 27.3.19.3 and 27.3.15.3, this can be an indication of a security attack.

If I2R LMR reporting was negotiated, then the ISTA shall include a CFO parameter in the I2R LMR; see [[9.6.7.49](#H09o6o7o49)](file:///C:\Users\yanjuns\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\O267OKM1\11-23-0887-00-00bk-tb-ranging.docx#H09o6o7o48) (Location Measurement Report (LMR) frame format). The ISTA shall estimate the CFO parameter based on the PPDU carrying the TF Ranging Sounding frame that solicits the I2R NDP from the ISTA. The RSTA may account for clock rate differences between ISTA and RSTA based on the CFO parameter included in the received I2R LMR. The mechanism by which t4 and t1 are adjusted by the RSTA is implementation specific. The CFO parameter refers to the t1 and t4 indicated in the same I2R LMR.

If the Invalid Measurement field in an R2I LMR or I2R LMR is equal to 1, the RSTA or ISTA receiving the LMR should discard the TOA carried in the LMR.

In TB ranging measurement reporting phase, if R2I LMR reporting or I2R LMR reporting carries phase shift feedback, then the R2I LMR reporting or the I2R LMR reporting shall be immediate feedback.

In TB ranging measurement reporting phase, if R2I AOA feedback was negotiated the RSTA shall include the optional AOA feedback subfield in the R2I LMR frame and if I2R LMR reporting was negotiated in addition to I2R AOA Feedback reporting then the ISTA shall include the optional AOA feedback subfield in the I2R LMR frame. The AOA field contains the Direction Measurement Results element described in 9.4.2.300.