



**IEEE Standard for Information Technology—
Telecommunications and Information Exchange between Systems
Local and Metropolitan Area Networks—
Specific Requirements**

**Part 11: Wireless LAN Medium Access Control
(MAC) and Physical Layer (PHY) Specifications**

Amendment 3: 320 MHz positioning

IEEE Computer Society

Developed by the
LAN/MAN Standards Committee

IEEE Std 802.11bk™-2025

(Amendment to IEEE Std 802.11™-2024
as amended by IEEE Std 802.11bh™-2024,
and IEEE Std 802.11be™-2024)

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Approved 28 May 2025

IEEE SA Standards Board

Abstract: Modifications to both the IEEE 802.11 medium access control layer (MAC) and physical layers (PHY) are defined in this amendment. It enhances the Fine Timing Measurement protocol to make use of 320 MHz wide channels available with the IEEE 802.11be PHY and MAC.

Keywords: amendment, direction measurement, Fine Timing Measurement, FTM, IEEE 802.11™, IEEE 802.11bk™, positioning, ranging

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Introduction

This introduction is not part of IEEE Std 802.11bk-2025, IEEE Standard for Information Technology—Telecommunications and Information Exchange between Systems—Local and Metropolitan Area Networks—Specific Requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications—Amendment 3: 320 MHz Positioning.

This amendment to IEEE Std 802.11-2024 defines modifications to both the IEEE 802.11 medium access control layer (MAC) and physical layers (PHY). It enhances the Fine Timing Measurement protocol to make use of 320 MHz wide channels available with the IEEE 802.11be PHY and MAC.

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**IEEE Standard for Information Technology—
Telecommunications and Information Exchange between Systems
Local and Metropolitan Area Networks—
Specific Requirements**

**Part 11: Wireless LAN Medium Access Control
(MAC) and Physical Layer (PHY) Specifications**

Amendment 3: 320 MHz positioning

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using strikethrough (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

3. Definitions, acronyms, and abbreviations

3.2. Definitions specific to IEEE 802.11

Change two definitions in 3.2 as follows:

HE-long training field (LTF) repetitions: [LTF repetitions] Multiple transmissions of high efficiency (HE)-long training field (LTF), next generation vehicle to everything (NGV)-LTF, or extremely high throughput (EHT)-LTF symbols in an HE Ranging null data PPDU, (NDP), NGV Ranging NDP, or HE trigger based (TB) Ranging NDP, EHT Ranging NDP, or EHT TB Ranging NDP, where an ~~HE~~-LTF repetition value of 1 indicates no repetitions, and, for example, a value of 2 ~~or 3~~ would indicate twice ~~or three times~~ as many HE-LTF, NGV-LTF, or EHT-LTF symbols, respectively.

...

Null-SAC HE-LTF: ~~Null-sequence Authentication Code (SAC)-Long Training field (LTF):~~ [Null-SAC-LTF] An HE-LTF ~~or EHT-LTF field value as a result of a SAC mismatch between an initiating STA (ISTA) to and a responding STA (RSTA), present in an initiating STA (ISTA) to a responding STA (RSTA) null data PPDU (NDP), or RSTA to ISTA NDP in the Ranging frame exchange, resulting from a mismatch of sequence authentication code (SAC) subfield in the STA Info field of a Ranging NDP Announcement frame, or the SAC subfield in the Trigger Dependent User Info field in the Ranging Secure Sounding Trigger frame, with either the Validation SAC subfield in the Secure HE LTF Parameters element in the last transmitted FTM frame, or the last transmitted Location Measurement Report frame to the ISTA, or is equal to 0. The TXVECTOR LTF_KEY and LTF_IV parameter corresponding to this LTF are set to generate any a secure HE LTF or null.~~

8. PHY service specification

8.3 Detailed PHY service specifications

Change 8.3.5 as follows:

8.3.5 PHY SAP detailed service specification

8.3.5.15 PHY-RXEND.indication

8.3.5.15.2 Semantics of the service primitive

...

- *IntegrityCheckError*. This value is used to indicate that during the reception of the HE Ranging NDP, ~~or~~ HE TB Ranging NDP, EHT Ranging NDP, or EHT TB Ranging NDP an integrity check was performed and failed.

8.3.5.18 PHY-RXLTFSEQUENCE.request

8.3.5.18.1 Function

This primitive is a request by the MAC sublayer to the local PHY entity to provide the parameters shown in Table 27-3 (LTFVECTOR parameters) for the receipt of an HE Ranging NDP, EHT Ranging NDP, or HE TB Ranging NDP or EHT TB Ranging NDP.

8.3.5.18.2 Semantics of the service primitive

The primitive provides the following parameter:

```
PHY-RXLTFSEQUENCE.request(  
    LTFVECTOR  
)
```

The LTFVECTOR represents a list of parameters needed to receive an HE Ranging NDP, EHT Ranging NDP, or HE TB Ranging NDP, or EHT TB Ranging NDP, including the HE-LTF or EHT-LTF configuration and information on how to generate the secure ~~HE-LTF~~ symbols as described in 27.3.20.6 and 36.3.19b.4.

8.3.5.18.3 When generated

This primitive is issued by the MAC sublayer to the PHY entity before receiving HE Ranging NDP, ~~and~~ HE TB Ranging NDP, EHT Ranging NDP, and EHT TB Ranging NDP.

8.3.5.18.4 Effect of receipt

The effect of receipt of this primitive is to configure by the PHY entity with the following parameters, as they are not signaled in the PPDU header:

- ~~is to be aware of the number of spatial streams and~~ The number of HE-LTF or EHT-LTF repetitions,
- If secure LTF is used, the information needed to generate the secure LTF symbols based on the parameters in the LTFVECTOR as described in 27.3.20.6 and 36.3.19b.4.
- The number of spatial streams in an HE TB Ranging NDP, and HE Ranging NDP, EHT TB Ranging NDP, and EHT Ranging NDP.

~~that are not signaled in the HE SIG-A of the HE Ranging NDP and HE TB Ranging NDP, as well as to be able to generate the secure LTF symbols based on the parameters in the LTFVECTOR as described in 27.3.20.6 (Construction of secure HE LTF symbols), if secure HE LTF is used.~~

9. Frame formats

9.3 Format of individual frame types

9.3.1 Control frames

9.3.1.19 NDP Announcement frame format

9.3.1.19.4 Ranging NDP Announcement frame format

Change the text in seven paragraphs of 9.3.1.19.4 as follows:

When used as part of the TB ranging measurement exchange, see 11.21.6.4.3, the LTF Offset, R2I NSTS, and R2I Rep subfields are used to indicate the following R2I NDP's HE-LTF configuration, see 27.3.19.1; the I2R NSTS and the I2R Rep subfields are reserved.

When used as part of the non-TB ranging measurement exchange, the I2R NSTS and I2R Rep subfields are used to indicate the following I2R NDP's HE-LTF configuration, see 27.3.19.1 or I2R NDP's EHT-LTF configuration, see 36.3.4.1, while the R2I NSTS and R2I Rep subfields indicate the HE-LTF configuration or EHT-LTF configuration of the R2I NDP, respectively, sent in response by the RSTA, see 11.21.6.4.4.

The LTF Offset subfield is used in the TB ranging measurement exchange protocol with secure LTF (see 11.21.6.4.5.2); it indicates the number of HE-LTF or EHT-LTF to skip when processing the following NDP. The LTF Offset subfield is set to 0 in all other cases.

The R2I NSTS and I2R NSTS subfields indicate the number of spatial streams of the corresponding NDP and is are set to the number of spatial streams minus 1.

The R2I Rep and I2R Rep subfields are set to the number of ~~HE-LTF~~ repetitions of the corresponding HE Ranging NDP minus 1; i.e., the LTF repetitions of the corresponding HE Ranging NDP (see 27.3.19.1), or

EHT Ranging NDP (see 36.3.4.1). If the I2R and R2I Rep subfields have a value equal to 0, then there is no ~~HE~~-LTF repetition in the I2R and R2I NDP₁ respectively.

The Disambiguation subfield is set to 1 as in the STA Info field in an HE NDP Announcement frame regardless of the AID11 subfield.

The format of the STA Info field in a Ranging NDP Announcement frame when the AID is equal to 2043 is shown in Figure 9-84. It is used in the non-TB ranging measurement exchange with secure LTF to carry the sequence authentication code (SAC).

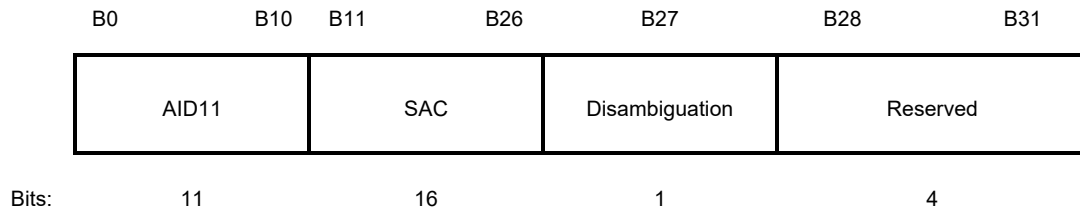


Figure 9-84—STA Info field format in a Ranging NDP Announcement frame if the AID11 is 2043

The SAC subfield contains the 16-bit SAC used in the non-TB ranging measurement exchange with secure LTF; see 11.21.6.4.5.3.

9.3.1.22 Trigger frame format

9.3.1.22.4 HE variant User Info field

Change Table 9-54 in 9.3.1.22.4 as follows:

Table 9-54—UL Target Receive Power subfield in Trigger frame

UL Target Receive Power subfield	Description
0–90	The expected received signal power, in units of dBm, is $Target_{pwr} = -110 + F_{val}$, where F_{val} is the subfield value.
91–126	Reserved
127	The STA transmits the TB PPDU at the STA's maximum transmit power for the assigned ~~HE~~-MCS. <u>If the eliciting trigger frame is a Sounding Ranging Trigger frame or a Passive Sounding Ranging Trigger frame, then the STA uses the maximum transmit power for HE-MCS 0 for an HE TB Ranging NDP and an HE Ranging NDP or EHT-MCS 0 for an EHT TB Ranging NDP and an EHT Ranging NDP.</u> <u>If the eliciting trigger frame is a Secure Sounding Ranging Trigger frame, then the STA uses the maximum transmit power for HE-MCS 6 for an HE TB Ranging NDP or EHT-MCS 6 for an EHT TB Ranging NDP.</u> <u>NOTE—The expected receive signal power is then the STA's maximum transmit power for the assigned HE or EHT MCS minus the path loss.</u> <u>If the Trigger frame is a Sounding or Passive Sounding Ranging Trigger frame that does not assign an HE MCS, then the STA's transmit power is that used for HE-MCS 0.</u>

UL Target Receive Power subfield	Description
	If the Trigger frame is a Secured Sounding Ranging Trigger frame that does not assign an HE MCS, the assigned HE MCS is assumed to be HE MCS 6 in terms of setting the STA's transmit. NOTE The expected receive signal power is then the STA's maximum transmit power for the assigned HE MCS minus the path loss.

Change 9.3.2.22.14 as follows:

9.3.1.22.14 Ranging Trigger-variant frame format

The Ranging Trigger Subtype subfield-value in the Trigger Dependent Common Info field of the Ranging Trigger frame, ~~see as defined by Table 9-56, indicates~~ signals the Ranging Trigger frame subvariants, ~~which can be one of five Trigger frame types: Poll, Sounding, Secure Sounding, Report and Passive Sounding Ranging Trigger frame.~~

The format of the Trigger Dependent Common Info subfield for the Poll, Sounding, Secure Sounding, and Report Ranging Trigger frame, is shown in Figure 9-102. The Token field in the Trigger Dependent Common Info subfield is used in a Poll Ranging Trigger frame to match it with the partial TSF time in a following Ranging NDP Announcement frame. It is reserved in all other Ranging Trigger frame subvariants.

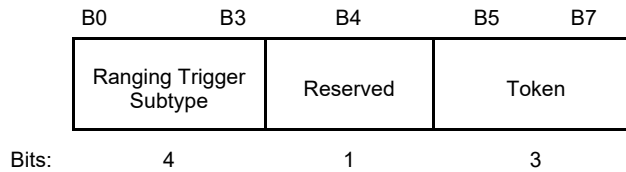


Figure 9-102—Trigger Dependent Common Info subfield format for the Ranging Trigger subvariants Poll, Sounding, Secure Sounding, and Report

The format of the Trigger Dependent Common Info subfield of a Ranging Trigger frame of subvariant Passive Sounding is shown in Figure 9-103. The Sounding Dialog Token Number subfield contains a value in the range of 0 to 63, which identifies a Measurement Sounding phase (I2R NDP and R2I NDP announced by a Sounding Trigger frame and the Ranging NDP Announcement frame, respectively), and the same value is included in the Sounding Dialog Token field of the Ranging NDP Announcement frame transmitted within the same availability window; see 9.3.1.19.

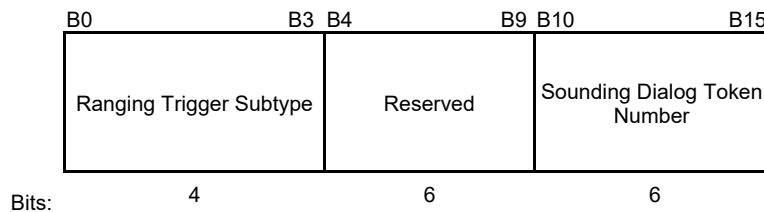


Figure 9-103—Trigger Dependent Common Info subfield format of the Passive Sounding Ranging Trigger frame

The value of the Ranging Trigger Subtype subfield for the Ranging Trigger frame is defined in Table 9-56.

Table 9-56—Ranging Trigger Subtype subfield encoding

Ranging Trigger Subtype subfield value	Ranging Trigger frame subvariant
0	Poll
1	Sounding
2	Secure Sounding
3	Report
4	Passive Sounding
5–15	Reserved

The RA field, and the CS Required and UL BW subfields in the Common Info field of the Ranging Trigger frame are identical to the Basic Trigger frame described in 26.5.2, 35.5.2, and 9.3.1.22, except that the RA field in Ranging Trigger frames with only one User Info field that is not a Special User info field (see 9.3.1.22.3) may be is either an unicast or broadcast individual or a group address.

The More TF subfield of the Common Info field of the Ranging Trigger frame indicates whether a subsequent Poll Ranging Trigger frame is scheduled for transmission within the availability window as defined in 11.21.6.4.3.

When a Ranging Trigger frame is addressed to ISTAs ~~that all have in~~ a TB ranging measurement exchange, see 11.21.6.4.3, with the same RSTA's BSSID, the TA field of the Ranging Trigger frame is set to the RSTA's address. The TA field is set to the transmitted BSSID, if the Trigger frame is addressed to a set of ISTAs in which at least two ISTAs are have in a TB ranging measurement exchange with different BSSIDs in the Multiple BSSID set of the RSTA.

9.3.1.23 Subvariants of Ranging Trigger variant

9.3.1.23.1 Poll subvariant

Change 9.3.1.23.1 as follows:

The format of the User Info field in the Poll Ranging Trigger frame is defined in Figure 9-104.

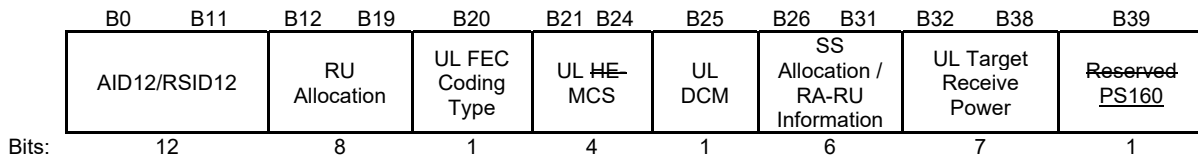


Figure 9-104—User Info field format for the Poll and Report Ranging Trigger

The AID12/RSID12 subfield carries either the ~~12~~twelve LSBs of the AID for an associated ISTA or the ~~12~~twelve LSBs of the RSID for an unassociated ISTA. The ~~RU Allocation~~, UL FEC Coding Type, ~~UL HE-MCS~~, UL DCM, ~~SS Allocation/RA-RU Information~~, and UL Target Receive Power subfields are identical to the corresponding subfield in the Basic Trigger frame; see 9.3.1.22.

If the Poll Ranging Trigger frame is soliciting an HE TB PPDU:

- The RU Allocation, UL DCM, and SS Allocation/RA-RU Information subfields are identical to the corresponding subfields in the HE variant User Info field (9.3.1.22.4).
- The UL MCS subfield is identical to the UL HE MCS subfield in the HE variant User Info field.
- The PS160 subfield is reserved.

If the Poll Ranging Trigger frame is soliciting an EHT TB PPDU:

- The RU Allocation, SS Allocation/RA-RU Information, and PS160 subfields are identical to the corresponding subfields in the EHT variant User Info field (9.3.1.22.5).
- The UL MCS subfield is identical to the UL EHT MCS subfield in the EHT variant User Info field.
- The UL DCM subfield is reserved.

The Trigger Dependent User Info subfield is not present in the Poll Ranging Trigger frame.

9.3.1.23.2 Sounding subvariant

The format of the User Info field in the Sounding Ranging Trigger frame is defined in Figure 9-105.

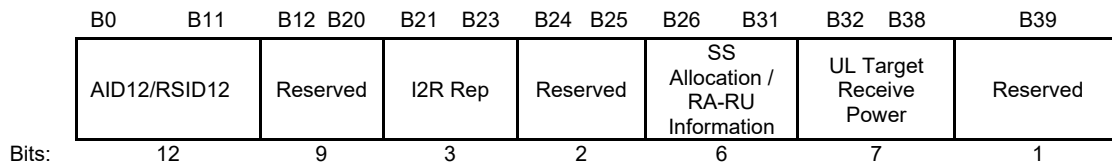


Figure 9-105—User Info field format for Sounding subvariant

The Trigger Dependent User Info subfield is not present in the Sounding Ranging Trigger frame.

The AID12/RSID12 subfield is identical to the corresponding subfield in the Poll Ranging Trigger frame.

The I2R Rep subfield indicates the number of ~~HE~~-LTF repetitions in the corresponding HE TB Ranging NDP or EHT TB Ranging NDP from the STA indicated in the AID12/RSID12 subfield; the I2R Rep subfield is set to the number of ~~HE~~-LTF repetitions minus 1. The value of the I2R Rep subfield is the same in all User Info fields in a single Trigger frame. If the Sounding Ranging Trigger frame is soliciting an HE TB Ranging NDP, the SS Allocation/RA-RU Information and UL Target Receive Power subfields are identical to the corresponding subfields in the HE variant User Info field of a Basic Trigger frame; see 9.3.1.22 9.3.1.22.4. If the Sounding Ranging Trigger frame is soliciting an EHT TB Ranging NDP, the SS Allocation/RA-RU Information and UL Target Receive Power subfields are identical to the corresponding subfields in the EHT variant User Info field of a Basic Trigger frame; see 9.3.1.22.5.

In both the HE variant Common Info field and the EHT variant Common Info field, the UL STBC, LDPC Extra Symbol Segment, Pre-FEC Padding Factor, and PE Disambiguity subfields are reserved.

The GI And HE-LTF Type subfield in the HE variant Common Info field is set to 1 ($2 \times \text{HE-LTF} + 1.6 \mu\text{s GI}$). The GI And HE/EHT-LTF Type field in the EHT variant Common Info field is set to 1 ($2 \times \text{EHT-LTF} + 1.6 \mu\text{s GI}$). The MU-MIMO HE-LTF Mode subfield in the HE variant Common Info field is set to 0 (HE single stream pilot HE-LTF mode).

The Doppler subfield in the HE variant Common Info field is set to 0.

NOTE—The UL Length subfield of a Trigger frame is computed using Equation (27-11) (see 26.5.2.2.4) for soliciting HE PPDU and Equation (36-11) (see 35.5.2.2.4) for soliciting EHT PPDU, which is based on the TXTIME computed in 27.4.3 for HE PPDU and 36.4.3 for EHT PPDU. In case of Sounding Ranging Trigger frame, the resulting UL Length value is equivalent to $13 + 6 \times N_{LTF-REP}N_{HE-LTF}$, where $N_{LTF-REP}$ is the number of ~~HE~~-LTF repetitions (given by the I2R Rep subfield value plus 1) and N_{HE-LTF} is the number of ~~HE~~-LTF symbols (given by the Number Of HE-LTF Symbols And Midamble Periodicity subfield), see Figure 9-90a; or is the Number Of HE/EHT-LTF Symbols subfield, see Figure 9-90b.

9.3.1.23.3 Secure sounding subvariant

The format of the User Info field in the Secure Sounding Ranging Trigger is defined in Figure 9-106. There is a single User Info field that is not a Special User Info field in a Secure Sounding Ranging Trigger frame.

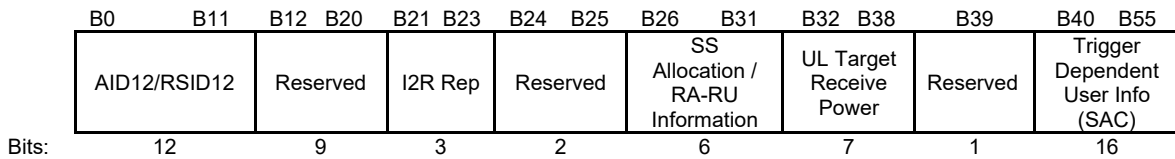


Figure 9-106—User Info field for Secure Sounding subvariant

The AID12/RSID12 subfield is identical to the corresponding subfield in the Poll Ranging Trigger frame.

The I2R Rep subfield is identical to the corresponding subfield in the Sounding Ranging Trigger frame.

The SS Allocation/RA-RU Information and UL Target Receive Power subfields are identical to the corresponding subfields in the Sounding Ranging Trigger frame; see 9.3.1.23.2. ~~Basic Trigger frame; see 9.3.1.22.~~

The Trigger Dependent User Info subfield is present in the Secure Sounding Ranging Trigger frame. The Trigger Dependent User Info subfield carries the Sequence Authentication Code (SAC) field. The SAC subfield provides the authentication information for the LTF Sequence Generation information used for the I2R sounding associated with the measurement instance; see 11.21.6.4.5. The length of this subfield is 16 bits.

NOTE—For measurement exchange with secure ~~HE~~-LTF, the I2R Rep is set to the *RSTA Assigned I2R Rep*; see 11.21.6.3.4.

~~In the Common Info field, the MU MIMO HE LTF Mode, UL STBC, LDPC Extra Symbol Segment, Pre-FEC Padding Factor, and PE Disambiguity subfields are reserved. The GI And HE LTF Type and Doppler subfields in the The HE variant Common Info field and EHT variant Common Info field are set as in the Sounding Ranging Trigger frame; see 9.3.1.23.2.~~

9.3.1.23.4 Report subvariant

The format of the User Info field in the Report Ranging Trigger frame is defined in Figure 9-104 and the subfields of the User Info field are identical to the corresponding subfields in the Poll Ranging Trigger frame soliciting an HE TB PPDU or an EHT TB PPDU.

The Trigger Dependent User Info subfield is not present in the Report Ranging Trigger frame.

9.3.1.23.5 Passive sounding subvariant

The Passive Sounding Ranging Trigger frame follows the definition of the Sounding Ranging Trigger frame except that the RA field is always set to the broadcast address. There is a single User Info field that is not a Special User Info field in a Passive Sounding Ranging Trigger frame.

9.4 Management and Extension frame body components

9.4.2 Elements

9.4.2.1 General

Change Table 9-130 as follows (the entire table is not shown):

Element	Element ID	Element ID Extension	Extensible	Fragmentable
...				
Puncture Pattern Element	254	1	Yes	No
Secure HE-LTF Parameters (see 9.4.2.301)	255	94	Yes	No

9.4.2.166 FTM Parameters element

Change Figure 9-723 as follows:

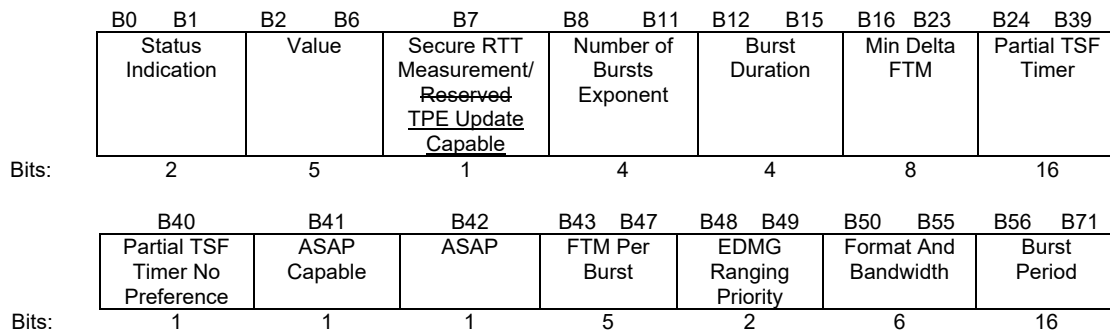


Figure 9-723—FTM Parameters field format

Change 9.4.2.166 FTM Parameters element as follows:

For secure EDMG ranging, the Secure RTT Measurement/TPE Update Capable subfield is set to 1 by an ISTA to request a secure RTT measurement exchange between an ISTA and an RSTA; see 11.21.6.3.32. The Secure RTT Measurement/TPE Update Capable subfield is set to 1 by an RSTA to acknowledge a secure RTT measurement exchange, and to 0 otherwise. ~~In cases other than secure EDMG ranging, the Secure RTT Measurement subfield is reserved.~~ For EDCA based ranging of non-EDMG STAs, the Secure RTT Measurement/TPE Update Capable subfield is set to 1 to indicate that a STA is capable of transmitting or receiving the Transmit Power Envelope element during the FTM session, and to 0 otherwise.

9.4.2.239 Non-Inheritance element

Change Table 9-373 bit 8 as follows:

Table 9-373—Extended RSN Capabilities field

Bit	Information	Notes
...	...	...
8	Secure ~~HE~~ -LTF Support	A STA sets the Secure ~~HE~~ -LTF Support field to 1 when dot11SecureLTFImplemented is true. Otherwise, the STA sets the Secure ~~HE~~ -LTF Support field to 0. See 11.21.6.4.5.
...	...	...

9.4.2.300 Ranging Parameters element

Change Figure 9-1044 as follows:

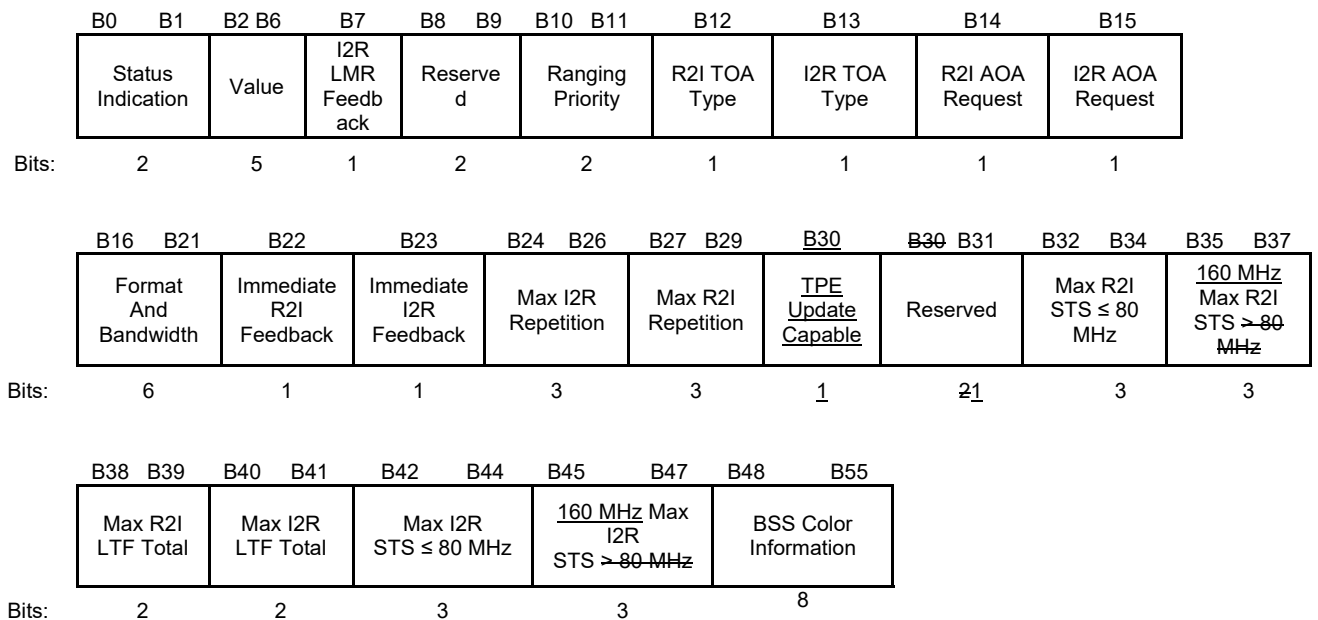


Figure 9-1044—Ranging Parameters field format

... ..

Change the text in 9.4.2.300 following the NOTE as follows:

NOTE—The values of 0 to 7 contained in the Max I2R Repetition and Max R2I Repetition subfields are mapped to the values 1 to 8 for the number of HE-LTF repetitions, respectively.

The TPE Update Capable subfield is set to 1 to indicate that a STA is capable of transmitting or receiving the Transmit Power Envelope element during the FTM session, and to 0 otherwise.

The Ranging Priority subfield of the Ranging Parameters field of the Ranging Parameters element in the IFTMR frame contains the ISTA's ranging priority request, which indicates the time sensitivity of a ranging operation, and it is set according to Table 9-323.

Change the following table and text in 9.4.2.300:

The Format And Bandwidth subfield indicates the requested or allocated PPDU format and bandwidth used to transmit the I2R/R2I NDP exchange as part of the non-TB ranging, or TB ranging measurement exchange; see 11.21.6.4.3 and 11.21.6.4.4. The encoding of this subfield is given in Table 9-412.

Table 9-412—Format And Bandwidth subfield

Field value	Format	Bandwidth
0	HE	20
1	HE	40
2	HE	80
3	HE	80+80
4	HE (two separate RF LOs)	160
5	HE (single RF LO)	160
6	NGV	10
7	NGV	20
8	<u>EHT</u>	<u>320</u>
89–63	Reserved	Reserved
NOTE—Values 6 and 7 are supported only when dot11NGVOptionImplemented is true.		

The values of 3, 4, and 5 indicate STA support for 160 MHz operation as either 80+80, 160 two-LO, or 160 single-LO, respectively, in addition to supporting 80 MHz, 40 MHz, and 20 MHz bandwidths (e.g., a field value of 5 does not mean the device supports all 160 MHz options but rather 160 MHz single LO).

The field value of 8 specifies the STA support for 320 MHz operation as 320 MHz using EHT format in addition to supporting 160 single RF LO, 80, 40, and 20 MHz bandwidths in HE format.

Change the paragraph in 9.4.2.300 as follows:

The 160 MHz Max R2I STS ~~> 80 MHz~~ subfield indicates for a ~~bandwidths greater than 80~~ 160 MHz bandwidth the maximum number of space-time streams to be used in R2I NDP in the session.

... ..

Change the text in 9.4.2.300 as follows:

The Max R2I LTF Total and Max I2R LTF Total subfields indicate the maximum number of HE-LTFs or EHT-LTFs to be destined to an ISTA in the R2I NDP and an RSTA in an I2R NDP, respectively, the encoding is given in Table 9-413. The maximum number of HE-LTFs or EHT-LTFs limits the allowed combinations of the number of space-time streams and ~~HE-LTF~~ repetitions.

Table 9-413—Max R2I/I2R LTF Total subfields

Field value	Max number of HE-LTFs or EHT-LTFs
0	4
1	8
2	16
3	64

Change the following paragraph in 9.4.2.300 as follows:

The 160 MHz Max I2R STS ~~>80 MHz~~ subfield indicates for ~~a bandwidths greater than 80 of 160 MHz bandwidth~~ the maximum number of space-time streams to be used in I2R NDP in the session.

Insert one new subelement ID for the 320 MHz Ranging subelement in the table as follows:

Table 9-414—Ranging Subelement IDs for Ranging Parameters

Subelement ID	Name	Extensible
0	Non-TB Specific subelement	Yes
1	TB-specific subelement	Yes
2	Secure HE-LTF subelement	Yes
<u>3</u>	<u>320 MHz Ranging subelement</u>	<u>Yes</u>
~~34~~ 220	Reserved	
221	Vendor Specific	
222–255	Reserved	

... ..

Change the following paragraphs in 9.4.2.300 as shown:

The Secure ~~HE~~-LTF subelement is included in the IFTMR frame to indicate that the initiator supports use of secure ~~HE~~-LTF and the associated parameters; it is included in the IFTM if the initiator and the responder successfully negotiate an FTM session where secure ~~HE~~-LTF is used.

The format of the Secure ~~HE~~-LTF subelement is as shown in Figure 9-1050.

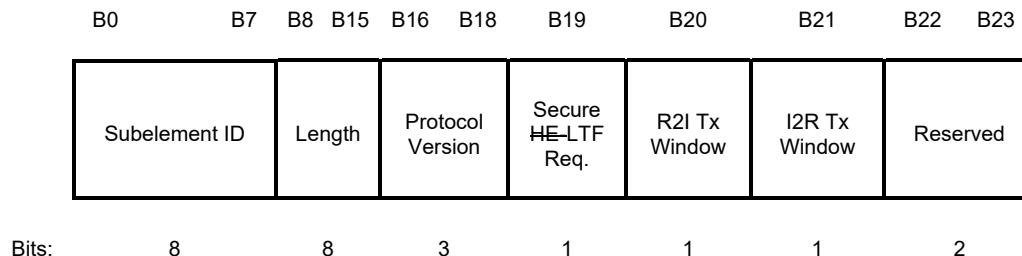


Figure 9-1050—Secure HE-LTF subelement format

The Subelement ID and Length fields are defined in Figure 9-1050.

The Protocol Version field in the IFTMR frame is set to the value 0 by the ISTA, with values 1 to 7 reserved for future use; see Table 9-415. In the IFTM frame, the Version field is set to the value 0 by the RSTA, with values 1 to 7 reserved for future use. The interpretation of the version field in the IFTMR frame and IFTM frame, and the possible resulting actions, are described in 11.21.6.3.4.

The Secure ~~HE~~-LTF Required field is set to 1 by the ISTA to indicate it requires secure ~~HE~~-LTF to be enabled and is set to 1 by the RSTA to enable a secure ~~HE~~-LTF measurement exchange between an ISTA and an RSTA. Otherwise, the Secure ~~HE~~-LTF Required field is set to 0.

The R2I Tx Window field in the IFTMR frame is set to 1 to indicate the ISTA requests use of the optional frequency domain Tx Window in the R2I NDPs, and 0 to indicate the default frequency domain Tx window. In the IFTM frame, the R2I Tx Window field is set to 1 to indicate the RSTA will use the optional frequency domain Tx window in the R2I NDPs, and 0 to indicate the default frequency domain Tx window; see Table 9-415.

The I2R Tx Window field in the IFTMR frame is set to 1 to indicate that the ISTA supports use of the optional frequency domain Tx window in the I2R NDPs, and 0 to indicate the default frequency domain Tx window. In the IFTM frame, the I2R Tx Window field is set to 1 by the RSTA to request that the ISTA use the optional frequency domain Tx window in the I2R NDPs, and 0 to indicate the default frequency domain Tx window; see Table 9-415.

Table 9-415 Secure ~~HE~~-LTF protocol section identifier

Protocol Version	Secure ~~HE~~ -LTF PHY sections
0	27.3.19 <u>36.3.19a</u>
1–7	Reserved

Insert the following definition for the new subelement at the end of this subclause:

The format of the 320 MHz Ranging subelement follows the definition in Figure 9-1078. The Subelement field is set according to Table 9-414. The Length field is defined in 9.4.3.

The Data field format is as shown in Figure 9-1050a.

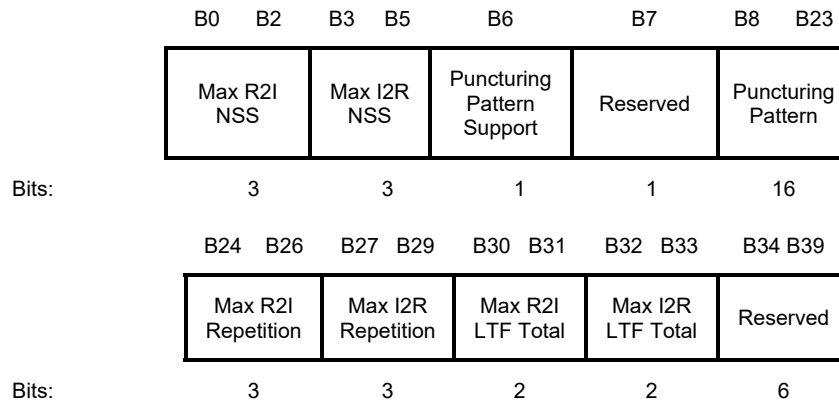


Figure 9-1050a—320 MHz Ranging subelement Data field format

The Max R2I NSS field indicates the maximum number of spatial streams to be used in an R2I NDP for 320 MHz PPDU bandwidth transmissions in the session.

The Max I2R NSS field indicates the maximum number of spatial streams to be used in an I2R NDP for 320 MHz PPDU bandwidth transmissions in the session.

The Puncturing Pattern Support field is set to 1 to indicate support of all puncturing patterns as listed in Table 36-30; it is set to 0 to indicate support of only the subset of puncturing patterns defined in Table 11-14aa.

The Puncturing Pattern field is used by the RSTA to convey the disabled subchannel bitmap to the ISTA in the IFTM frame. It is reserved when included in the IFTMR frame by the ISTA.

The Max R2I Repetition field indicates the maximum number of LTF repetitions that the RSTA uses in the preamble of an R2I NDP for 320 MHz PPDU bandwidth transmission; the subfield is set to the number of LTF repetitions minus 1.

The Max I2R Repetition field indicates the maximum number of LTF repetitions that the ISTA uses in the preamble of an I2R NDP for 320 MHz PPDU bandwidth transmission; the subfield is set to the number of LTF repetitions minus 1.

The Max R2I LTF Total and Max I2R LTF Total fields indicate the maximum number of EHT-LTFs to be destined to an ISTA in the R2I NDP and an RSTA in an I2R NDP, respectively, for 320 MHz PPDU bandwidth transmission. The encoding is given in Table 9-413.

Change “HE-LTF” to “LTF” in the following subclauses and Figure 9-1049 as shown:

9.4.2.301 Secure ~~HE~~-LTF Parameters element

The Secure ~~HE~~-LTF Parameters element is optionally included in the IFTM frame, as described in 9.6.7.33, and the LMR frame, as described in 9.6.7.49, for a secure ~~HE~~-LTF measurement exchange mode of the non-TB ranging and TB ranging measurement exchange (see 11.21.6.4.5). The use of the Secure ~~HE~~-LTF Parameters element is described in 11.21.6.

The format of the Secure ~~HE~~-LTF Parameters element is shown in Figure 9-1051.

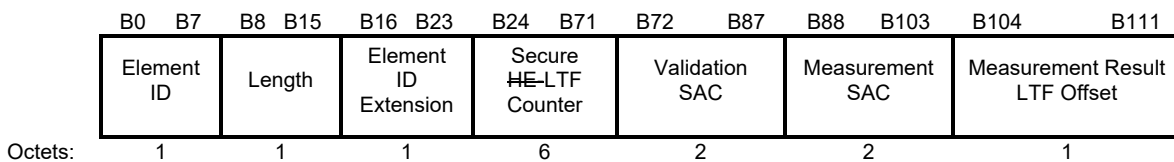


Figure 9-1051—Secure ~~HE~~-LTF Parameters element format

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1.

The Secure ~~HE~~-LTF Counter field is used to determine the randomized LTF sequence of an I2R NDP and R2I NDP in one of the following secure ~~HE~~-LTF measurement exchange sequences:

- An I2R NDP and an R2I NDP immediately following a Ranging NDP Announcement frame, in a non-TB ranging measurement exchange (11.21.6.4.4).
- A sequence of an I2R NDP, a Ranging NDP Announcement frame, an R2I NDP, in a TB ranging measurement exchange (11.21.6.4.3).