IEEE P802.11
Wireless LANs

|  |
| --- |
| Comment Resolution SA1 – HE-LTF Repetitions |
| Date: 2021-11-10 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Christian Berger | NXP | 350 Holger Way, San Jose, CA |  | christian.berger@nxp.com |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Abstract

This submission proposes the comment resolution of CIDs 287679, 287656, 287662, 287663, 287678, 287680, 287683, 288235, 288236, 288297, 288298, 288299, 288300, 288301, 288302, 288305; as part of SA1, changes are relative to Draft 4.0.

Revisions:

1. Added resolution text

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 TGax Draft. This introduction is not part of the adopted material.

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

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

**The text preceded by “Discussion” is not part of the adopted changes.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| **287679** | 20.18 | 3.2 | Add a defintition of "HE-LTF repetitions" or "LTF repetitions" | Add an entry as "HE-LTF repetitions: multiple transmissions of HE-LTF symbols in an HE Ranging NDP or HE TB Ranging NDP, where an HE-LTF repetition value of 1 indicates no extra repetitions, and, e.g., a value of 2 or 3 would indicate twice or three times as many HE-LTF symbls respectively." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **287656** | 46.1 | 9.3.1.19 | "The R2I Rep and I2R Rep subfields are set to N\_LTF\_REP minus 1, where N\_LTF\_REP is the number of HE-LTF repetitions of the corresponding HE Ranging NDP; see 27.3.18a (HE Ranging NDP). If the I2R and R2I Rep subfields have a value equal to 0, then there is no repetition." - not clear what the point of N\_LTF\_REP is, we can just use words in this descriptive section | Change to "The R2I Rep and I2R Rep subfields are set to the number of HE-LTF repetitions of the corresponding HE Ranging NDP minus 1, see 27.3.18a (HE Ranging NDP). If the I2R and R2I Rep subfields have a value equal to 0, then there are no repetition in the I2R and R2I NDP respectively." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **287662** | 51.8 | 9.3.1.22.10.2 | "The I2R Rep subfield is set to N\_LTF\_REP minus 1, where N\_LTF\_REP is the number of HE- LTF repetitions in the corresponding HE TB Ranging NDP from the STA indicated in the AID12/RSID12 subfield." - remove N\_LTF\_REP | Change to "The I2R Rep subfield indicates the number of HE- LTF repetitions of the corresponding HE 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." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **287663** | 51.22 | 9.3.1.22.10.3 | "The I2R Rep subfield signals the number of repetitions N\_REP of the HE LTF symbols in the corresponding HE TB Ranging NDP from the STA indicated in the AID12/RSID12 subfield." Repetitive | Change to "The I2R Rep subfield is identical to the corresponding subfield in the Sounding Ranging Trigger frame." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **287678** | 77.32 | 9.4.2.298 | "The Max I2R Repetition subfield indicates the maximum N\_LTF\_REP minus 1, where N\_LTF\_REP is the maximum number of HE-LTF repetitions that the ISTA uses in the preamble of I2R NDP." - remove N\_LTF\_REP | Change to "The Max I2R Repetition subfield indicates the maximum number of HE-LTF repetitions that the ISTA uses in the preamble of the I2R NDP, the subfield is set to the number of HE-LTF repetitions minus 1." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **287680** | 77.35 | 9.4.2.298 | "The Max R2I Repetition subfield indicates the maximum N\_LTF\_REP minus 1, where N\_LTF\_REP is the maximum number of HE-LTF repetitions that the RSTA uses in the preamble of R2I NDP. The values of 0 to 7 contained in the Max I2R Rep and Max R2I Rep subfield are mapped to 1 to 8 in the N\_LTF\_REP parameter, the number of HE-LTF repetitions, respectively; see 9.3.1.19 (VHT/HE/Ranging NDP Announcement frame format), 9.3.1.22.10.2 (Sounding subvariant) and 9.3.1.22.10.3 (Secured Sounding subvariant)." | Change to "The Max R2I Repetition subfield indicates the maximum number of HE-LTF repetitions that the RSTA uses in the preamble of the R2I NDP, the subfield is set to the number of HE-LTF repetitions minus 1. " | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **287683** | 78.37 | 9.4.2.298 | "The maximum number of LTFs limits the allowed combinations of number of space-time streams and LTF repetitions." Use 'HE-LTF repetitions' | Change to "The maximum number of LTFs limits the allowed combinations of number of space-time streams and HE-LTF repetitions." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288235** | 132.11 | 11.21.6.3.3 | "In Ranging Parameters field of the Ranging Parameters element of the IFTM frame, an RSTA sets the Max R2I Repetition subfield to RSTA Assigned R2I Rep, and sets the Max I2R Repetition subfield to RSTA Assigned I2R Rep." - duplication, RSTA behavior described in paragraph starting at line 42/ page 133, also line 31, page 134 | remove | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288236** | 132.14 | 11.21.6.3.3 | "When RSTA Assigned R2I Rep is equal to 0, N\_LTF\_REP in the corresponding HE Ranging NDP 14 is equal to 1 and there is a single HE-LTF segment without repetition. When RSTA Assigned R2I 15 Rep is greater than 0 , N\_LTF\_REP in the corresponding HE Ranging NDP is greater than 1 and 16 HE-LTF repetition is used. When RSTA Assigned I2R Rep is equal to 0, N\_LTF\_REP in the 17 corresponding HE Ranging NDP or HE TB Ranging NDP is equal to 1 and there is a single HE-18 LTF segment without repetition; when RSTA Assigned I2R Rep is greater than 0, N\_LTF\_REP in 19 the corresponding HE Ranging NDP is greater than 1 and HE-LTF repetition is used." some duplication, also the use of these parameters is described in sublcause 11.21.6.4 and PHY sections | remove | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288297** | 236.32 | 27.3.18a.1 | "The TXVECTOR parameter LTF\_REP that indicates N\_LTF\_REP, the number of the HE LTF repetitions. A value of N\_LTF\_REP equal to 1 indicates a single HE-LTF segment without repetition, and a value of N\_LTF\_REP greater than 1 indicates the use of HE-LTFrepetitions. For decoding the HE-LTF fields, a PHY-RXLTFSEQUENCE.request primitive issued from the MAC provides the LTF\_REP parameter and LTF\_OFFSET parameter, which are not encoded in the HE-SIG-A, but included in the preceding Ranging NDP Announcement frame. The LTF\_OFFSET parameter indicates the number of secure HE-LTF symbols to skip for receiving the corresponding user’s HE-LTF field, e.g., in Figure 27-46d the LTF\_OFFSET for the first and second user would be 0 and 4 respectively"" - this is an overview, too much detail, move to later; also remove N\_LTF\_REP" | Change to "The TXVECTOR parameter LTF\_REP indicates the number of the HE LTF repetitions. For decoding the HE-LTF fields, a PHY-RXLTFSEQUENCE.request primitive issued from the MAC provides the LTF\_REP parameter and LTF\_OFFSET parameter, which are not encoded in the HE-SIG-A, but included in the preceding Ranging NDP Announcement frame. The LTF\_OFFSET parameter indicates the number of secure HE-LTF symbols to skip for receiving the corresponding user’s HE-LTF field." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288298** | 237.18 | 27.3.18a.1 | "The number of HE-LTF symbols is the product of the number of HE-LTF repetitions N\_LTF\_REP and the conventional number of HE-LTF" - remove use of N\_LTF\_REP, not defined in PHY | Change to "The number of HE-LTF symbols is the product of the number of HE-LTF repetitions, given in LTF\_REP, and the conventional number of HE-LTF" | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288299** | 237.11 | 27.3.18a.1 | "The number of HE-LTF symbols in an HE Ranging NDP depends on the number of space-time streams N\_STS, the number of HE-LTF repetitions N\_LTF\_REP, and when Secure HE-LTFs are used, the number of users NUM\_USERS." remove N\_LTF\_REP, not defined here | Change to "The number of HE-LTF symbols in an HE Ranging NDP depends on the number of space-time streams N\_STS, the number of HE-LTF repetitions LTF\_REP, and when Secure HE-LTFs are used, the number of users NUM\_USERS." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288300** | 237.21 | 27.3.18a.1 | "The construction of the HE-LTFs in an HE Ranging NDP is done by repeating the steps in Subclause 27.3.6.9 (Construction of HE-LTF) N\_LTF\_REP times." - remove N\_LTF\_REP and move sentence from bullet points here | Change to "The construction of the HE-LTFs in an HE Ranging NDP is done by repeating the steps in Subclause 27.3.6.9 (Construction of HE-LTF) LTF\_REP times, i.e., a value of LTF\_REP equal to 1 indicates a single HE-LTF segment without repetition, and a value of TF\_REP greater than 1 indicates the use of HE-LTF repetitions." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288301** | 237.30 | 27.3.18a.1 | "The total number of HE-LTF symbols is the product of the number of HE-LTF repetitions N\_LTF\_REP and NHE-LTF, the number of HE-LTF based on the number of space-time streams N\_STS, as defined in Table 21-13 (Number of VHT-LTFs required for different numbers of space-time streams). (#2499, #4014) For Secure HE-LTF trasnmissions, the number of LTF repetitions LTF\_REP shall be greater than 1." - remove N\_LTF\_REP, not defined her - and the PHY should encode whatever the TXVECTOR says, not have some extra rules. | Change to "The total number of HE-LTF symbols is the product of the number of HE-LTF repetitions, given in LTF\_REP, and N\_HE-LTF, the number of HE-LTF based on the number of space-time streams N\_STS, as defined in Table 21-13 (Number of VHT-LTFs required for different numbers of space-time streams). (#2499, #4014)" | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288302** | 238.3 | 27.3.18a.1 | "When the TXVECTOR parameter SECURE\_LTF\_FLAGis set to 1 and the NUM\_USERS parameter is larger than 1, the TXVECTOR parameters LTF\_KEY, NUM\_STS and N\_LTF\_REP will be in array form with NUM\_USERS entries. The number of Secure HE-LTF will depend on the sum of: NHE-LTF times N\_LTF\_REP, across all users." remove N\_LTF\_REP, not defined here | Change to "When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 1 and the NUM\_USERS parameter is larger than 1, the TXVECTOR parameters LTF\_KEY, NUM\_STS and LTF\_REP will be in array form with NUM\_USERS entries. The number of Secure HE-LTF will depend on the sum of: N\_HE-LTF times LTF\_REP, across all users." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx |
| **288305** | 239.25 | 27.3.18a.2 | "The number of HE-LTF symbols in an HE TB Ranging NDP is the product of the usual number of HE-LTF symbols NHE-LTF and N\_LTF\_REP, the number of HE-LTF repetitions. A value of N\_LTF\_REP equal to 1 indicates a single HE-LTF segment without repetition, and a value of N\_LTF\_REP greater than 1 indicates the use of HE-LTF repetitions." -remove N\_LTF\_REP, not defined here | Change to "The number of HE-LTF symbols in an HE TB Ranging NDP is the product of the usual number of HE-LTF symbols N\_HE-LTF and the number of HE-LTF repetitions, given in LTF\_REP. A value of LTF\_REP equal to 1 indicates a single HE-LTF segment without repetition, and a value of LTF\_REP greater than 1 indicates the use of HE-LTF repetitions." | **Revised**TGaz editor, make changes depicted inhttps://mentor.ieee.org/802.11/dcn/21/11-21-1841-01-00az-comment-resolution-sa1-he-ltf-repetitions.docx  |

TGaz Editor: Change text on page 20 starting at line 18 as follows

3.2 Definitions specific to IEEE 802.11

***Insert the new definitions into 3.2 in alphabetical order:***

**Enhanced Directional Multi-Gigabit (EDMG) secure ranging physical layer (PHY) protocol data unit (PPDU)**: An EDMG single user (SU) PPDU that contains Secure training (TRN) subfields in the training (TRN) field to enable secure ranging with physical layer (PHY) level security. (#**2020**, #**1486**)

**HE-LTF repetitions:** multiple transmissions of HE-LTF symbols in an HE Ranging NDP or HE TB Ranging NDP, where an HE-LTF repetition value of 1 indicates no extra repetitions, and, e.g., a value of 2 or 3 would indicate twice or three times as many HE-LTF symbls respectively.

**LMR frame**: A Location Measurement Report frame.

**non-TB ranging: A** ranging measurement procedure that uses NDP, and is not initiated by a Ranging Trigger frame.(#**3482**)

TGaz Editor: Change text on page 46 starting at line 1 as follows

The R2I N\_STS and I2R N\_STS subfields indicate the number of space-time streams of the corresponding NDP (see NUM\_STS parameter in [28.2.2](file:///C%3A%5CUsers%5Cnxf57284%5CDocuments%5CIEEE%5CDraft%20P802.11az_D4.0_FOR_CB.docx#H28o2o2) (TXVECTOR and RXVECTOR parameters) (#**1610**) and is set to the number of space-time 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; see [27.3.18a](file:///C%3A%5CUsers%5Cnxf57284%5CDocuments%5CIEEE%5CDraft%20P802.11az_D4.0_FOR_CB.docx#H27o3o18a) (HE Ranging NDP). If the I2R and R2I Rep subfields have a value equal to 0, then there is no repetition in the I2R and R2I respectively. (#**5435**, #**5452**, #**5376**)

TGaz Editor: Change text on page 51 starting at line 8 as follows

The I2R Rep subfield indicates the number of HE-LTF repetitions in the corresponding HE 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. (#**1116**, #**1584**) The value of the I2R Rep subfield is the same in all User Info fields in the Trigger frame. (#**5435**, **5452**, **5376**)

The SS Allocation/RA-RU Information and UL Target Receive Power subfields are identical to the corresponding subfields in the Basic Trigger frame; see [9.3.1.22](file:///C%3A%5CUsers%5Cnxf57284%5CDocuments%5CIEEE%5CDraft%20P802.11az_D4.0_FOR_CB.docx#H09o3o1o22) (Trigger Frame format). (#**3827**)

TGaz Editor: Change text on page 51 starting at line 22 as follows

The I2R Rep subfield is identical to the corresponding subfield in the Sounding Ranging Trigger frame. (#**1583**, #**5007**)

TGaz Editor: Change text on page 52 starting at line 8 as follows

9.3.1.22.10.5 Passive Sounding subvariant (#1707, #5006, #5237)

The Passive Sounding Ranging Trigger frame follows the definition of the Sounding Ranging Trigger frame except that the RA field is always (#**2285**) set to the broadcast address. (#**1116**, #**1584, #1615**, #**5435**, #**5452**, #**5376**)

TGaz Editor: Change text on page 77 starting at line 32 as follows

The Max I2R Repetition subfield indicates the maximum number of HE-LTF repetitions that the ISTA uses in the preamble of I2R NDP, the subfield is set to the number of HE-LTF repetitions minus 1. (#**5435**, #**5452**, #**5376**)

The Max R2I Repetition subfield indicates the maximum number of HE-LTF repetitions that the RSTA uses in the preamble of R2I NDP, the subfield is set to the number of HE-LTF repetitions minus 1. (#**5435**, #**5452**, #**5376**)

TGaz Editor: Change text on page 77 starting at line 32 as follows

The Max R2I LTF Total and Max I2R LTF Total subfields indicate the maximum number of LTFs used in the R2I and I2R NDP respectively, the encoding is given in Table [9-322h23fc](file:///C%3A%5CUsers%5Cnxf57284%5CDocuments%5CIEEE%5CDraft%20P802.11az_D4.0_FOR_CB.docx#T09o322h23fc) (Max R2I/I2R LTF Total subfields). The maximum number of LTFs limits the allowed combinations of number of space-time streams and HE-LTF repetitions. (#**5428**) (#**TC707r3**)

TGaz Editor: Change text on page 132 starting at line 11 as follows

TGaz Editor: Change text on page 133 starting at line 42 as follows

When the negotiation is successful for TB ranging and non-TB ranging, the corresponding IFTM frame from the RSTA shall include a Ranging Parameters element with the parameters that defines the negotiated range measurement session. The RSTA shall indicate the following parameters in the Ranging Parameters field: (#**3591, #TC707r3**)

* In the Max R2I Rep field, it assigns the maximum number of HE-LTF repetitions in the preamble of the R2I NDP for this session (referred to as RSTA Assigned R2I Rep). This value shall not be greater than the value in the corresponding IFTMR frame.
* In the Max I2R Rep field, it assigns the maximum number of HE-LTF repetitions in the preamble of the I2R NDP for this session (referred to as RSTA Assigned I2R Rep). This value shall not be greater than the value in the corresponding IFTMR frame.
* In the Max R2I STS ≤ 80 MHz subfield, either the maximum number of space-time streams it is capable of transmitting in the R2I NDP for bandwidths less than or equal to 80 MHz, or the value in the corresponding IFTMR frame, whichever is smaller (referred to as RSTA Assigned R2I STS ≤ 80 MHz).
* In the Max R2I STS > 80 MHz subfield, either the maximum number of space-time streams it is capable of transmitting in the R2I NDP for bandwidths greater than 80 MHz, or the value in the corresponding IFTMR frame (referred to as RSTA Assigned R2I STS > 80 MHz).
* In the Max I2R STS ≤ 80 MHz subfield, either the maximum number of space-time streams it is capable of receiving in the I2R NDP for bandwidths less than or equal to 80 MHz, or the value in the corresponding IFTMR frame, whichever is smaller (referred to as RSTA Assigned I2R STS ≤ 80 MHz).
* In the Max I2R STS > 80 MHz subfield, either the maximum number of space-time streams it is capable of receiving in the I2R NDP for bandwidths greater than 80 MHz, or the value in the corresponding IFTMR frame, whichever is smaller (referred to as RSTA Assigned I2R STS > 80 MHz).
* In the Max R2I LTF Total subfield, either the maximum number of LTFs in total it is capable of transmitting, including HE-LTF repetitions, in the R2I NDP, or the value in the corresponding IFTMR frame, whichever is smaller (referred to as RSTA Assigned R2I LTF Total).
* In the Max I2R LTF Total subfield, either the maximum number of LTFs in total it is capable of receiving, including HE-LTF repetitions, in the I2R NDP, or the value in the corresponding IFTMR frame, whichever is smaller (referred to as RSTA Assigned I2R LTF Total). (#**3700**)

TGaz Editor: Change text on page 236 starting at line 16 as follows

* Uses HE-LTFs (#**5217**) or Secure HE-LTFs when the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 0 or 1 respectively.
* Secure HE-LTFs use randomized LTF sequences, pseudorandom and deterministic per stream phase rotation and when the TXVECTOR parameter TX\_WINDOW\_FLAG is set to 1, a frequency domain flat top window, instead of the frequency domain rectangular window; see 27.3.18d (Construction of Secure HE-LTF). (#3215, #3354, #3911, #3920, #4018, #5216)
* Uses HE-LTF repetitions, indicated in the TXVECTOR parameter LTF\_REP by values larger one.
* Has a Packet Extension (PE) field that is 4 µs in duration. No energy is transmitted during the first 1.6 µs of the PE field if the HE-LTF field is using the secure HE-LTF, similar to no energy being transmitted during the GI of HE-LTF symbols. (#5465)
* When the TXVECTOR parameter NUM\_USERS is more than 1, the TXVECTOR parameter NUM\_STS[1] is used to encode the NSTS And Mid-amble Periodicity field of the HE-SIG-A1. Otherwise, the TXVECTOR parameter NUM\_STS is used to encode the NSTS And Mid-amble Periodicity field of the HE-SIG-A1.
* For decoding the HE-LTF fields, a PHY-RXLTFSEQUENCE.request primitive issued from the MAC provides the LTF\_REP parameter and LTF\_OFFSET parameter, which are not encoded in the HE-SIG-A, but included in the preceding Ranging NDP Announcement frame. The LTF\_OFFSET parameter indicates the number of secure HE-LTF symbols to skip for receiving the corresponding user’s HE-LTF field. (#**3271**, #**5435**, #**5452**, #**5376**)

The only supported mode is 2x HE-LTF with 1.6 µs GI. The other combinations of HE-LTF modes and GI duration are disallowed. (#**4014**) No energy is transmitted during the GI of the HE-LTF symbols when secure HE-LTF is used, which is referred to as a zero-power GI. (#**5465**)

The number of HE-LTF symbols in an HE Ranging NDP depends on the number of space-time streams N\_STS, the number of HE-LTF repetitions, and when Secure HE-LTFs are used, the number of users NUM\_USERS.



1. Figure 27-46b—Example of HE-LTFs in an HE Ranging NDP with N\_STS=2 and LTF\_REP =2 (#4014, #5452)

When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 0, HE-LTFs (#**5217**) as defined in Subclause 27.3.11.10 (HE-LTF) are used in the HE Ranging NDP. The number of HE-LTF symbols is the product of the number of HE-LTF repetitions, given in LTF\_REP, and the conventional number of HE-LTF, NHE-LTF, based on the number of space-time streams N\_STS, as defined in Table 21-13 (Number of VHT-LTFs required for different numbers of space-time streams). The construction of the HE-LTFs in an HE Ranging NDP is done by repeating the steps in Subclause 27.3.6.9 (Construction of HE-LTF) LTF\_REP times, i.e., a value of LTF\_REP equal to 1 indicates a single HE-LTF segment without repetition, and a value of LTF\_REP greater than 1 indicates the use of HE-LTF repetitions. If the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 0, the TXVECTOR parameter NUM\_USERS is not present which is then assumed to be 1.

When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 1, Secure HE-LTFs as defined in [27.3.18d](file:///C%3A%5CUsers%5Cnxf57284%5CDocuments%5CIEEE%5CDraft%20P802.11az_D4.0_FOR_CB.docx#H27o3o18d) (Construction of Secure HE-LTF), are used and the Packet Extension field will be partially replaced by a zero power GI in its first 1.6 µs, see Figure [27-46c](file:///C%3A%5CUsers%5Cnxf57284%5CDocuments%5CIEEE%5CDraft%20P802.11az_D4.0_FOR_CB.docx#F27o46c) (HE Ranging NDP format with Secure HE-LTFs). For the secure HE-LTF symbol or Packet Extension field with zero power GI, the time domain signal has zero power during the period of the GI. The total number of HE-LTF symbols is the product of the number of HE-LTF repetitions, given in LTF\_REP, and *NHE-LTF*, the number of HE-LTF based on the number of space-time streams N\_STS, as defined in Table 21-13 (Number of VHT-LTFs required for different numbers of space-time streams). (#**2499**, #**4014**)

TGaz Editor: Change text on page 238 starting at line 3 as follows

When the TXVECTOR parameter SECURE\_LTF\_FLAGis set to 1 and the NUM\_USERS parameter is larger than 1, the TXVECTOR parameters LTF\_KEY, NUM\_STS and N\_LTF\_REP will be in array form with NUM\_USERS entries. The number of Secure HE-LTF will depend on the sum of: NHE-LTF times LTF\_REP, across all users. In this case, the repetitions of the HE-LTF symbols are repetition of the structure for HE-LTF fields. The randomized HE-LTF sequences are different for HE-LTF repetitions. (#**2357**)

TGaz Editor: Change caption on page 238 starting at line 27 as follows



1. Figure 27-46d—Example of secure LTFs with NUM\_USERS=2, N\_STS=[2,1] and LTF\_REP =[2,2] (#4014, #5452)

TGaz Editor: Change text on page 239 starting at line 3 as follows

The HE TB Ranging NDP has the following properties:

* Uses the HE TB PPDU format but without the Data field.
* No beamforming steering matrix is applied to the waveform.
* HE-STF in HE TB Ranging NDP is the same as the HE-STF in a HE TB PPDU (#**5090**)
* Uses HE-LTFs or Secure HE-LTFs when the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 0 or 1 respectively.
* Secure HE-LTFs use randomized LTF sequences, pseudorandom and deterministic per stream phase rotation and when the TXVECTOR parameter TX\_WINDOW\_FLAG is set to 1, a frequency domain flat top window, instead of the frequency domain rectangular window; see [27.3.18d](file:///C%3A%5C%5CUsers%5C%5Cnxf57284%5C%5CDocuments%5C%5CIEEE%5C%5CDraft%20P802.11az_D4.0_FOR_CB.docx%22%20%5Cl%20%22H27o3o18d) (Construction of Secure HE-LTF). (#3215, #3354, #3911, #3920, #4018, #5216)
* Uses HE-LTF repetitions, indicated in the TXVECTOR parameter LTF\_REP by values larger one.
* Has a Packet Extension (PE) field that is 4 µs in duration. No energy is transmitted during the first 1.6 µs of the PE field if the HE-LTF field is using the secure HE-LTF, similar to no energy being transmitted during the GI of HE-LTF symbols. (#**5465**)
* For transmission of HE-LTFs, if NSTS = NTx, the Q matrix shall be an Identity matrix, and if NSTS < NTx, the Q matrix shall be an antenna selection matrix with no antenna swapping. The Q matrix becomes an Identity matrix when all 0 rows are removed. (#**3128**)

The only supported mode is the 2x HE-LTF with 1.6 µs GI. The other combinations of HE-LTF modes and GI duration are disallowed.

The number of HE-LTF symbols in an HE TB Ranging NDP is the product of the usual number of HE-LTF symbols NHE-LTF and the number of HE-LTF repetitions, given in LTF\_REP. A value of LTF\_REP equal to 1 indicates a single HE-LTF segment without repetition, and a value of LTF\_REP greater than 1 indicates the use of HE-LTF repetitions. The sum of Tx power shall remain constant throughout the entire HE TB Ranging NDP PPDU. (#**TC1007r1, #5435, #5452, #5376**)