IEEE P802.11Wireless LANs

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| Proposed Resolutions to 11az LB253 CIDs on LTF Repetitions |
| Date: 2021-07-06 |
| Author(s): |
| Name | Company | Address | Phone | email |
| Qi Wang | Apple Inc.  |  |  | qi\_wang2@apple.com |
| Tianyu Wu |  |  | tianyu@apple.com |

Abstract

This submission proposes the resolutions to 11az LB 253 CID – 5435, 5452, 5376, all on the subject of HE-LTF repetitions.

The page and line numbers for proposed changes refer to those in 11az Draft 3.0 [1].

**Introduction**

This submission proposes the resolutions to 11az LB 253 CID – 5435, 5452, 5376, all on the subject of HE-LTF repetitions.

The page and line numbers for proposed changes refer to those in 11az Draft 3.0 [1].

**Comments:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| CID | Page/Line | Clause | Comment | Proposed change | Resolution |
| 5435 | 44 | 9.3.1.19 | "The R2I Rep and I2R Rep subfields indicate the number of repetitions N\_REP of the HE-LTF symbols of the corresponding HE Ranging NDP beyond the number of space-time streams, see subclause 27.3.17a.27.3.18a (HE Ranging NDP)." Pleas clarify R2I Rep and I2R Rep represent the number of HE-LTFS minus 1. | modify the sentence to "The R2I Rep and I2R Rep subfields indicate the number of repetitions N\_REP of the HE-LTF symbols of the corresponding HE Ranging NDP beyond the number of space-time streams and is set to the number of HE-LTFs minus 1, see subclause 27.3.17a.27.3.18a (HE Ranging NDP)." | Revised. Agree with the commenter. N\_REP and LTF\_REP are redundant parameters and can be merged into one. Other related spec changes are also needed to make the 11az spec consistent. 11az editors: please incorporate the text changes in: [https://mentor.ieee.org/802.11/dcn/21/11-21-1079-00-00az-proposed -resolutions-to-11az-LB253-CIDs-on-LTF-Repetition.docx](https://mentor.ieee.org/802.11/dcn/21/11-21-1079-00-00az-proposed%20-resolutions-to-11az-LB253-CIDs-on-LTF-Repetition.docx) |
| 5376 | 44 | 9.3.1.19 | Mention R2I/I2R Rep = 0 indicates no repetition | As in comment. | Revised. Agree with the commenter. The clarifying text requested by the commenter is added to 11.21.6.3.3 and to the definition of “LTF\_REP”. 11az editors: please incorporate the text changes in: [https://mentor.ieee.org/802.11/dcn/21/11-21-1079-00-00az-proposed -resolutions-to-11az-LB253-CIDs-on-LTF-Repetition.docx](https://mentor.ieee.org/802.11/dcn/21/11-21-1079-00-00az-proposed%20-resolutions-to-11az-LB253-CIDs-on-LTF-Repetition.docx)  |
| 5452 | 156/29 | 11.21.6.4.4.2 | "The ISTA shall set the I2R Rep subfield and R2I Rep subfield in the STA Info field of the Ranging30 NDP Announcement frame each to a value not to exceed the RSTA assigned I2R rep and RSTA31 assigned R2I rep respectively. Furthermore, the total number of LTF in the I2R NDP and R2I NDP,32 based on the number of spatial streams and repetitions, shall not exceed the RSTA assigned I2R33 LTF Total and RSTA assigned R2I LTF Total respectively. (#TC707r3)". There is a need of statement that I2R Rep and R2I Rep need to be greater than 0 when secure LTF is used. | Please modify the text to indicate that when secure LTF is used, the actual assigned I2R Rep and R2I Rep need to be greater than 0, for both TB and Non-TB ranging. | Revised. Agree with the commenter. The revised text based on the commenter’s request is added to 11.21.6.3.3. 11az editors: please incorporate the text changes in: [https://mentor.ieee.org/802.11/dcn/21/11-21-1079-00-00az-proposed -resolutions-to-11az-LB253-CIDs-on-LTF-Repetition.docx](https://mentor.ieee.org/802.11/dcn/21/11-21-1079-00-00az-proposed%20-resolutions-to-11az-LB253-CIDs-on-LTF-Repetition.docx) |

**Discussion:**

CID – 5435, 5452, 5376 reveal the following issues in 11az\_D3.0:

1. The meanings of the field values of R2I /I2R Rep, Max R2I/I2R Rep, LTF\_REP, N\_REP are specified inconsistently.
2. The difference between parameters N\_REP and LTF\_REP are unclear.
3. The terms *RSTA Assigned R2I Rep* and *RSTA Assigned I2R Rep* are not explicitly defined before their use.
4. For secure LTF, although it’s specified that an ISTA shall set Max R2I Rep and Max I2R Rep to be greater than 0, the requirements on *RSTA Assigned R2I Rep* and *RSTA Assigned I2R Rep* to be greater than 0 are missing.

To resolve these issues, we propose 11az spec changes according to the following:

1. Change the name “N\_REP” to “N\_LTF\_REP” and describe it as the number of HE-LTF repetitions consistently.
2. Use “LTF\_REP” as the name of the relevant TX/RXVECTOR field.
3. Specify that the field values of R2I /I2R Rep, Max R2I/I2R Rep are LTF\_REP minus 1, where the field values of R2I /I2R Rep, Max R2I/I2R Rep of 0 to 7 map to LTF\_REP’s values of 1 to 8.
4. Explicitly define the term *RSTA Assigned R2I Rep* and *RSTA Assigned I2R Rep* before use.
5. Add a statement that for secure LTF, *RSTA Assigned R2I Rep* and *RSTA Assigned I2R Rep* shall be greater than 0.

**Proposed 11az spec change:**

**TGaz editors: please delete page 21, line 32 of 11az\_D3.0 as follows:**

**3.4 Abbreviations and acronyms**

**9.3.1.19 VHT/HE/Ranging NDP Announcement frame format**

**…**

**TGaz editors: please change page 44, L6-8 of 11az\_D3.0 as follows:**

The R2I Rep and I2R Rep subfields are set to N\_LTF\_REP, the number of HE-LTF repetitions of the corresponding HE Ranging NDP, minus 1, see 27.3.18a (HE Ranging NDP). (#5435, 5452, 5376)

**…**

**Sounding subvariant (#1707)**

…

**TGaz editors: please change page 49, L17-19 of 11az\_D3.0 as follows:**

The R2I Rep and I2R Rep subfields are set to N\_LTF\_REP, the number of HE-LTF repetitions of the corresponding HE Ranging NDP, minus 1, see 27.3.18a (HE Ranging NDP). (# 5435, 5452, 5376)

**TGaz editors: please change page 49, L26-27 of 11az\_D3.0 as follows:**

The I2R Rep subfield is set to N\_LTF\_REP, the number of HE-LTF repetitions of in the corresponding HE TB Ranging from the STA indicated in the AID12/RSID12 subfield, minus 1 (#**1583**). (#5435, 5452, 5376)

…

**Passive TB Measurement Exchange subvariant (#1707)**

…

**TGaz editors: please change page 50, L11-15 of 11az\_D3.0 as follows:**

The Ranging Trigger frame of Passive TB Ranging subvariant follows the definition of the Ranging Trigger frame of Sounding subvariant except that the RA field is always (#**2285**) set to the broadcast address and the I2R Rep subfield signals the N\_LTF\_REP, the number of HE-LTF repetitions in the corresponding HE Ranging NDP from the STA indicated in the AID12/RSID12 subfield, minus 1.  (#**1116**, #**1584, #1615**)

**9.4.2.298 Ranging Parameters element**

**TGaz editors: please change page 75, L3-8 of 11az\_D3.0 as follows:**

**…**

The Max I2R Repetition subfield indicates the maximum N\_LTF\_REP, the maximum number of HE-LTF repetitions that the ISTA uses in the preamble of I2R NDP, minus 1. (#5435, 5452, 5376)

The Max R2I Repetition subfield indicates the maximum N\_LTF\_REP, the maximum number of HE-LTF repetitions that the RSTA uses in the preamble of R2I NDP, minus 1. (#5435, 5452, 5376)

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). (#5435, 5452, 5376)

**…**

**11.21.6.3.3 Negotiation for TB and Non-TB Ranging measurement exchange**

**…**

If a Ranging Parameters element is included in the IFTMR frame, the ISTA shall indicate the following parameters in the Ranging Parameters field (#**TC707r3**):

 — maximum number of LTF repetitions it is capable of receiving in the preamble of the R2I NDP, in the Max R2I Rep subfield.

— maximum number of LTF repetitions it is capable of transmitting in the preamble of the I2R NDP, in the Max I2R Rep subfield.

— Maximum number of space-time streams it is capable of receiving in the R2I NDP for bandwidths less than or equal to 80 MHz, in the Max R2I STS ≤ 80 MHz subfield.

— Maximum number of space-time streams it is capable of receiving in the R2I NDP for bandwidths greater than 80 MHz, in the Max R2I STS > 80 MHz subfield.

* Maximum number of space-time streams it is capable of transmitting in the I2R NDP for bandwidths less than or equal to 80 MHz, in the Max I2R STS ≤ 80 MHz subfield.
* Maximum number of space-time streams it is capable of transmitting in the I2R NDP for bandwidths greater than 80 MHz, in the Max I2R STS > 80 MHz subfield.
* Maximum number of LTFs in total it is capable of receiving, including all repetitions, in the R2I NDP, in the Max R2I LTF Total subfield.
* Maximum number of LTFs in total it is capable of transmitting, including all repetitions, in the I2R NDP, in the Max I2R LTF Total subfield.

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.* (#5435, 5452, 5376)

When *RSTA Assigned R2I Rep* is equal to 0, N\_LTF\_REP in the corresponding HE Ranging NDP is equal to 1 and there is a single HE-LTF segment without repetition. When *RSTA Assigned R2I Rep* is greater than 0 , N\_LTF\_REP in the corresponding HE Ranging NDP is greater than 1 and HE-LTF repetition is used. When *RSTA Assigned I2R Rep* is equal to 0, N\_LTF\_REP in the corresponding HE Ranging NDP or HE TB Ranging NDP is equal to 1 and there is a single HE-LTF segment without repetition; when *RSTA Assigned I2R Rep* is greater than 0, N\_LTF\_REP in the corresponding HE Ranging NDP is greater than 1 and HE-LTF repetition is used. (#5435, 5452, 5376)

If an ISTA has included the Secure LTF subelement in the Ranging Parameters element in its IFTMR frame and sets the value of the Secure LTF Required field to 1, the ISTA shall set the Max R2I Rep and Max I2R Rep subfields to a value greater than 0, and both *RSTA Assigned R2I Rep* and *RSTA Assigned I2R Rep* shall begreater than 0. (#5435, 5452, 5376)

**…**

**11.21.6.4.5.2 TB Ranging Measurement Exchange with Secure LTF**

**...**

**TGaz editors: please change page 162, L13-15 of 11az\_D3.0 as follows:**

The RSTA shall set the I2R Rep subfield of the STA Info field corresponding to the ISTA in the Ranging Secure Sounding Trigger frame equal to the *RSTA Assigned I2R Rep* corresponding to the ISTA, where *RSTA Assigned I2R Rep* shall be greater than 0. (#5435, 5452, 5376)

**TGaz editors: please change page 163, L17-18 of 11az\_D3.0 as follows:**

The RSTA shall set the R2I Rep subfield of the STA Info field corresponding to the ISTA in the Ranging NDP Announcement frame equal to the *RSTA Assigned R2I Rep* to the ISTA, where *RSTA Assigned R2I Rep* shall be greater than 0. (#5435, 5452, 5376)

**TGaz editors: please change page 164, L8-16 of 11az\_D3.0 as follows:**

When an ISTA receives a Ranging NDP Announcement frame from an RSTA in which AID11/RSID11 subfield in the STA Info field contains the 11 least significant bits of the AID or RSID of the ISTA, the ISTA shall issue a PHY-RXLTFSEQUENCE.request primitive with the following LTFVECOR parameter values:

1. LTF\_OFFSET that is set to the LTF Offset subfield value in the STA Info field;
2. LTF\_N\_STS that is set to the R2I N\_STS subfield value in the STA Info field;
3. LTF\_REP that is set to the R2I Rep subfield value in the STA Info field plus 1; (#**3773**) (#5435, 5452, 5376)

**Non-TB Ranging Measurement Exchange with Secure LTF.**

**TGaz editors: please change page 167, L10-12 of 11az\_D3.0 as follows:**

The ISTA shall set the I2R Rep subfield and R2I Rep subfield of the STA Info field in the Ranging NDP Announcement frame to the *RSTA Assigned I2R Rep* and the *RSTA Assigned R2I Rep* values respectively, corresponding to the RSTA. Both *RSTA Assigned R2I Rep* and *RSTA Assigned I2R Rep* shall begreater than 0. (#5435, 5452, 5376)

* + - * 1. **Transmission of a ranging NDP**

**TGaz editors: please change page 174, L12-28 of 11az\_D3.0 as follows:**

* The LTF\_REP parameter is set as follows:
	+ In the TB Ranging measurement exchange (11.21.6.4.3), set to the same value as the R2I Rep field in the STA Info field in the preceding Ranging NDP Announcement frame plus 1.
	+ In the TB Ranging measurement exchange with Secure LTF (11.21.6.4.5.2): (#**3895**)
		- The LTF\_REP[*p*] is set to the same value as the R2I Rep field in the STA Info field addressed to the corresponding STA *p* in the preceding Ranging NDP Announcement frame plus 1 when the HE Ranging NDP is transmitted to more than one ISTA. (#5435, 5452, 5376)
		- The LTF\_REP is set to the same value as the R2I Rep field in the first STA Info field in the preceding Ranging NDP Announcement frame plus 1 when the HE Ranging NDP is transmitted to one ISTA.
	+ In the Non-TB Ranging measurement exchange (11.21.6.4.4) and the Non-TB Ranging measurement exchange with Secure LTF (11.21.6.4.5.3), set to the same value as the R2I Rep subfield in the STA Info field in preceding Ranging NDP Announcement frame plus 1.

**TGaz editors: please change page 175, L17 to P176 L29 of 11az\_D3.0 as follows:**

An ISTA transmitting an HE Ranging NDP shall set the TXVECTOR parameter as follows:

* The FORMAT parameter is set to HE\_SU
* The UPLINK\_FLAG parameter is set to 1
* The APEP\_LENGTH parameter is set to 0
* The NUM\_STS parameter is set to the same value as the I2R N\_STS subfield in the STA Info field in the preceding Ranging NDP Announcement frame plus 1.
* The LTF\_REP parameter is set to the same value as the I2R Rep subfield in the STA Info field in the preceding Ranging NDP Announcement frame plus 1. (#5435, 5452, 5376)
* The TXPWR\_LEVEL\_INDEX parameter is set to a value that matches the Tx Power value indicated in the I2R NDP Tx Power subfield in the STA Info field with the AID11 subfield set to 2045 in the preceding Ranging NPD Announcement frame, except if the value in the I2R NDP Tx Power subfield was set to a reserved value. (#**3883**)
* The CH\_BANDWIDTH set to the same value as the TXVECTOR parameter CH\_BANDWIDTH in the preceding Ranging NDP Announcement frame
* In the Non-TB Ranging measurement exchange with Secure LTF, the LTF\_KEY parameter is set as defined in 11.21.6.4.5.2 (Non-TB Ranging measurement exchange with Secure LTF). Otherwise, the LTF\_KEY parameter is not present
* The HE\_LTF\_TYPE parameter is set to 2xHE-LTF
* The GI\_TYPE parameter is set to either 0u8s\_GI or 1u6s\_GI
* The SPATIAL\_REUSE parameter is set to SRP\_AND\_NON-SRG\_OBSS- PD\_PROHIBITED
* The BSS\_COLOR parameter is set to the value indicated in the BSS Color subfield of the HE Operation element received from the RSTA
* The TXOP\_DURATION parameter is set to either 127 or a value defined in Equation (27-
* 2), replacing *D*HE\_Ranging NDP Announcement by *D*Ranging NDP Announcement which is the value of the Duration/ID field in the MAC header of the preceding Ranging NDP Announcement frame,

An ISTA transmitting an HE TB Ranging NDP to an RSTA shall set the TXVECTOR parameter as follows:

* The FORMAT parameter is set to HE\_TB
* The APEP\_LENGTH parameter is set to 0
* The NUM\_STS parameter is set to the same value as the Number Of Spatial Streams subfield in the SS Allocation field in the User Info field in the preceding Ranging Sounding Trigger frame
* The LTF\_REP parameter is set to the same value as the I2R Rep subfield in the User Info field in the preceding Ranging Sounding Trigger frame plus 1. (#**3868**)
* The CH\_BANDWIDTH parameter is set to the same value as the TXVECTOR parameter CH\_BANDWIDTH in the preceding Ranging Sounding Trigger frame
* In the TB Ranging measurement exchange with Secure LTF, the LTF\_KEY parameter is set as defined in 11.21.6.4.5.2 (TB Ranging measurement exchange with Secure LTF). Otherwise, the LTF\_KEY parameter is not present
* The HE\_LTF\_TYPE parameter is set to 2xHE-LTF The GI\_TYPE parameter is set to 1u6s\_GI
* The SPATIAL\_REUSE parameter is set to SRP\_AND\_NON- SRG\_OBSS\_PD\_PROHIBITED
* The BSS\_COLOR parameter is set to the value indicated in the BSS Color subfield of the HE Operation element received from the RSTA

The TXOP\_DURATION parameter is set as defined in 26.11.5 (TXOP\_DURATION)

**27.2 HE PHY service interface**

**27.2.2 TXVECTOR and RXVECTOR parameters**

(#**3215**, #**3354**, #**3911**, #**3920**, #**4018**)
***Insert the following new rows into the end of Table 27-1:***

**TGaz editors: please change the 11az\_D3.0 page 221 row on “LTF\_REP” in Table 27-1 as follows:**

**Table 27-1—TXVECTOR and RXVECTOR parameters (#3629)** (#5435, 5452, 5376)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Condition | Value | TXVECTOR | RXVECTOR |
| **…** | **…** | **…** | **…** | **…** |
| LTF\_REP  | FORMAT is either HE\_SU or HE\_TB and RANGING\_FLAG is 1 (#**1298**)  | Indicate the number of HE-LTF repetitions. Set to the number of repetitions.  | O | N |
| **…** | **…** | **…** | **…** | **…** |

**27.2.3a LTFVECTOR parameters**

The LTFVECTOR is carried in a PHY-RXLTFSEQUENCE.request for PHY of STA to receive HE Ranging NDP and the HE TB Ranging NDP. The parameters in Table 27-2a (LTFVECTOR parameters) are defined as part of the LTFVECTOR parameter list in the PHY- RXLTFSEQUENCE.request primitive.

(#**3215**, #**3354**, #**3911**, #**3920**, #**4018**)

**TGaz editors: please change the 11az\_D3.0 page 223 row on “LTF\_REP” in Table 27-2a as follows:**

**Table 27-2a—LTFVECTOR parameters**

|  |  |
| --- | --- |
| **Parameter**  | **Value**  |
| LTF\_KEY  | Contains the *rsta-ltf-key* (See 11.21.6.4.5.4 (Secure LTF Octet Stream Generation)) when receiving the secure HE-LTFs sent by an RSTA; see 11.21.6.4.6 (Secure Non-TB and -TB Ranging Measurement Exchange Protocol). Contains the *ista-ltf-key* (See 11.21.6.4.5.4 (Secure LTF Octet Stream Generation)) when receiving the secure HE-LTFs sent by an ISTA; see 11.21.6.4.6 (Secure Non-TB and -TB Ranging Measurement Exchange Protocol). Contains a null value if receiving the insecure HE-LTFs. (#**2289**, #**1828**, #**1831**).  |
| LTF\_IV  | Contains the *ltf-iv* (See 11.21.6.4.5.4 (Secure LTF Octet Stream Generation)) for secure HE-LTFs or null otherwise. Must be non-null if LTF\_KEY is not null.  |
| LTF\_OFFSET  | Indicates the number of HE-LTF to skip to receive in the following HE Ranging NDP.  |
| LTF\_N\_STS  | Indicate the number of space-time streams to receive in the following HE Ranging NDP or the following HE TB Ranging NDP.  |
| LTF\_REP  | Indicate the number of HE-LTF repetitions to receive in the following HE Ranging NDP or the following HE TB Ranging NDP. (#5435, 5452, 5476) |

**27.3.18a HE Ranging NDP**

**TGaz editors: please change the 11az\_D3.0 page 224, line 31- page 225 line 5, as follows:**

The TXVECTOR parameter LTF\_REP 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-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, e.g., in Figure 27-46d the LTF\_OFFSET for the first and second user would be 0 and 4 respectively  (#**3271**).

**TGaz editors: please change the 11az\_D3.0 page 225, line 9-11, as follows:**

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 with randomized LTF sequence are used, the number of users NUM\_USERS.

**TGaz editors: 11az\_D3.0 page 225, line 13, the caption for Figure 27-46b, please replace “LTF\_REP” with “N\_LTF\_REP”.**

**TGaz editors: please change the 11az\_D3.0 page 225, line 15-30, as follows:**

When the TXVECTOR parameter LTF\_KEY is not present, insecure HE-LTFs 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 N\_LTF\_REP and the conventional number of HE-LTF, N\_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). 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. If the TXVECTOR parameter LTF\_KEY is not present, neither is the TXVECTOR parameter NUM\_USERS, which is then assumed to be 1.

When the TXVECTOR parameter LTF\_KEY is present, Secure HE-LTFs as defined in 27.3.18d (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 (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 GI. 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 *NSTS*, as defined in Table 21-13 (Number of VHT-LTFs required for different numbers of space-time streams). (#**2499**, #**4014**)

**TGaz editors: please change the 11az\_D3.0 page 226, line 3-8, as follows:**

When the TXVECTOR parameter LTF\_KEY is present 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: N\_HE-LTF times N\_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 editors: 11az\_D3.0 page 226, line 13-14, the caption for Figure 27-46d, please replace “LTF\_REP” with “N\_LTF\_REP”.**

**27.3.18b HE TB Ranging NDP**

…

**TGaz editors: please change the 11az\_D3.0 page 227, line 14-15, as follows:**

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 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.

**References**

[1] IEEE P802.11az™/D3.0