IEEE P802.11Wireless LANs

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| Proposed Resolutions to 2 CIDs of 11az SAB1  |
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Abstract

This submission proposes the resolutions to 11az SAB1 CID-7122 and 7126.

The page and line numbers refer to those in 11az Draft 4.1 [1].

**Introduction**

This submission proposes the resolutions to 11az SAB1 CID- 7122 and 7126.

The page and line numbers refer to those in 11az Draft 4.1 [1].

**Comments:**

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| --- | --- | --- | --- | --- | --- |
| CID | Page/Line | Clause | Comment | Proposed change | Resolution |
| 7122 | 238/17 | 27.3.18a.1 | What does a "segment" mean? | Define "segment". | Revised. Agree with the commenter that segment is not clearly defined. “segment” can also be confused with frequency segment used in 11ax. As a result, HE-LTF field, HE-LTF User Block, and HE-LTF Repetition Block are defined to describe the structure of HE-LTFs of an HE Ranging NDP and an HE TB Ranging NDP. TGaz editor: please incorporate the text changes in submission 22/489r2<https://mentor.ieee.org/802.11/dcn/21/11-22-0489-02-00az-proposed-resolutions-to-SAB1-2CIDs.docx> |
| 7126 | 240/37 | 27.3.18a.2 | What is a “structure for HE-LTF fields”?  | Define “structure for HE-LTF fields”.  | Revised. Agree with the commenter that “structure for the HE-LTF fields” is not clearly defined. As a result, HE-LTF field, HE-LTF User Block, and HE-LTF Repetition Block are defined to describe the structure of HE-LTFs of an HE Ranging NDP and an HE TB Ranging NDP. TGaz editor: please incorporate the text changes in submission 22/489r2<https://mentor.ieee.org/802.11/dcn/21/11-22-0489-02-00az-proposed-resolutions-to-SAB1-2CIDs.docx> |

**Proposed resolution**

**27.3.11 HE Preamble**

**27.3.11.1 Introduction**

***TGaz Editors: Please modify the text on page 236/line 29 as shown below: (#7122, #7126)***

See 27.3.18a.1 and 27.3.18a.2 for HE preamble for HE Ranging NDP and HE TB Ranging NDP, respectively.

**27.3.18a HE Ranging NDP and HE TB Ranging NDP**

This subclause applies only to HE Ranging NDP and HE TB Ranging NDP. (#**5474**)

***TGaz Editors: Please change the text in 27.3.18a.1 as shown below: (#7122, #7126)***

**27.3.18a.1 HE Ranging NDP**

The format of an HE Ranging NDP is shown in Figure 27-46a (HE Ranging NDP format).



1. Figure 27-46a—HE Ranging NDP format (#4014)

The HE Ranging NDP has the following properties:

* Uses the HE SU PPDU format but without the Data field.
* The HE-STF in an HE Ranging NDP is the same as the HE-STF in an HE SU PPDU (#**5090**)
* 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 HE-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, if indicated in the TXVECTOR parameter LTF\_REP by values larger than one. (#**7347**)
* The HE-LTF field that consists of one or more HE-LTF User Blocks; each HE-LTF User Block contains one or more HE-LTF Repetition Blocks, where the number of HE-LTF Repetition Blocks is equal to LTF\_REP. An HE-LTF Repetition Block in an HE-LTF User Block comprises one or more HE-LTF symbols, NHE-LTF, calculated using the number of space-time streams NUM\_STS for this user, as defined in Table 21-13 (Number of VHT-LTFs required for different numbers of space-time streams).
* When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 0, the number of HE-LTF User Block is equal to 1, and the same HE-LTF User Block is applied to all users. When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 1, an HE-LTF User Block contains all HE-LTF symbols for one user, and the number of  HE-LTF User Blocks in the HE-LTF field is equal to the number of  Users, NUM\_USERS, and each HE-LTF User Block contains all the HE-LTF symbols for one user.
* No beamforming steering matrix is applied to the waveform. The Beamformed field in HE- SIG-A of an HE Ranging NDP is always set to 0. For transmission of HE-STFs and HE- LTFs, if NSTS = NTx, the Q matrix shall be an Identity matrix, and if NSTS < NTx, the Q matrix shall be based on an antenna selection matrix with no antenna swapping. The Q matrix becomes an Identity matrix when all 0 rows are removed. (#**2302**, #**3270**, #**5090**)
* 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 decoding the HE-LTF field, 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 User Block. (#**3271**, #**5435**, #**5452**, #**5376, #7347**)
* When the TXVECTOR parameter NUM\_USERS is greater 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.
* 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 the HE-LTF field in an HE Ranging NDP depends on the number of space-time streams NUM\_STS, the number of HE-LTF repetitions, LTF-REP, and when Secure HE-LTFs are used, the number of users NUM\_USERS. (#7347)

See examples in Figure 27-46b (An example of HE-LTF field in an HE Ranging NDP with NUM\_USERS=1, NUM\_STS=2 and LTF\_REP =2) and Figure 27-46d (Example of Secure HE-LTF field with NUM\_USERS=2, NUM\_STS=[2,1] and LTF\_REP =[2,2]).

***TGaz Editors: Replace Figure 27-46b with the figure below and change the caption as shown below. (#7122, #7126)***

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**Figure 27-46b—An example of HE-LTFs in an HE Ranging NDP with NUM\_USERS =1, NUM\_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. There is a single HE-LTF User Block in an HE-LTF field, and the total number of HE-LTF symbols in the HE-LTF field is the product of the number of symbols in an HE-LTF Repetition Block, NHE-LTF, and the number of HE-LTF repetitions, given in LTF\_REP.

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 no repetition, i.e., a single HE-LTF Repetition Block is included in an HE-LTF User Block, and a value of LTF\_REP greater than 1 indicates the use of repetitions, i.e., multiple HE-LTF Repetition Blocks are included in an HE-LTF User Block. 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, and all the HE-LTF symbols belong to a single HE-LTF User Block.. (#**7347**)

When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 1, 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 the GI. The TXVECTOR parameters LTF\_KEY, NUM\_STS and LTF\_REP will be in array form with NUM\_USERS entries. The repetitions of the HE-LTF symbols are repetition of the HE-LTF Repetition Block. The randomized HE-LTF sequences are different for the HE-LTF repetitions. (#**2357**). The total number of HE-LTF symbols in an HE-LTF User Block is the product of the number of symbols in an HE-LTF Repetition Block, NHE-LTF, and the number of HE-LTF repetitions, given in LTF\_REP.

For Secure HE-LTF transmissions, the number of HE-LTF repetitions given in LTF\_REP shall be greater than 1, and there are a minimum of two HE-LTF Repetition Blocks in each HE-LTF User Block.. (#**7347**)



1. Figure 27-46c—HE Ranging NDP format with Secure HE-LTFs

NOTE—The intended receiver can use the LTF repetitions to check for consistency of the channel estimates across the HE-LTF Repetition Blocks. One metric that can be used for the consistency check is to take the mean-squared error between consecutive channel estimates and compare against a threshold relative to the measured noise power. (#**5189**, #**5192**)

The Secure HE-LTFs of each HE-LTF User Block are concatenated one after another and form the HE-LTF field of an HE Ranging NDP; the total number of HE-LTF symbols in an HE-LTF field shall not exceed a maximum of 64.

In the HE modulated fields, within the HE-LTF field, in each HE-LTF User Block, the number of Tx antennas are the same as the number indicated in NUM\_STS for the corresponding user and may vary from one HE-LTF User Block to the other. Within the HE-STF Field, the number of Tx antennas should match the first HE-LTF User Block. In the pre-HE modulated fields, the number of Tx antennas used shall be no less than the minimum number of Tx antennas used in the HE modulated fields. The sum of the Tx power across all Tx antennas shall remain constant throughout the entire HE Ranging NDP PPDU. (#**TC1007r1**)

***TGaz Editors: Please replace Figure 27-46d and the caption with the figure and caption shown below: (#7122, #7126)***

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**Figure 27-46d— An example of secure LTFs with NUM\_USERS=2, NUM\_STS=[2,1] and LTF\_REP = [2,2] (#4014, #5452, #7349)**

***TGaz Editors: Please change the text in 27.3.18a.2 as shown below. (#7122, #7126)***

**27.3.18a.2 HE TB Ranging NDP**

The format of an HE TB Ranging NDP is shown in Figure 27-46e (HE TB Ranging NDP format).



1. Figure 27-46e—HE TB Ranging NDP format (#4014)

The HE TB Ranging NDP has the following properties:

* Uses the HE TB PPDU format but without the Data field.
* 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 HE-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 [27.3.18a.4](#H27o3o18ao4) (Construction of Secure HE-LTF). (#3215, #3354, #3911, #3920, #4018, #5216)
* Uses HE-LTF repetitions, if indicated in the TXVECTOR parameter LTF\_REP by values larger than one. (#**7352**)
* The HE-LTF field of an HE TB Ranging NDP consists a single HE-LTF User Block. The HE-LTF User Block contains one or more HE-LTF Repetition Blocks, and the number of HE-LTF Repetition Blocks is equal to LTF\_REP. Each HE-LTF Repetition Block in the HE-LTF User Block comprises of one or more HE-LTF symbols, NHE-LTF, calculated using the SS Allocation within the Sounding Ranging Trigger frame for this user.
* 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**)
* No beamforming steering matrix is applied to the waveform.
* 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 number of HE-LTF symbols in an HE-LTF Repetition Block, NHE-LTF, and the number of HE-LTF repetitions, given in LTF\_REP. A value of LTF\_REP equal to 1 indicates no repetition, i.e., a single HE-LTF Repetition Block is included in an HE-LTF User Block, and a value of LTF\_REP greater than 1 indicates the use of repetitions, i.e., multiple HE-LTF Repetition Blocks are included in an HE-LTF User Block. The sum of Tx power shall remain constant throughout the entire HE TB Ranging NDP PPDU. (#**TC1007r1, #5435, #5452, #5376**, #**7352**)

When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 0, HE-LTFs as defined in Subclause 27.3.11.10 (HE-LTF) are used in each HE-LTF Repetition Block.

When the TXVECTOR parameter SECURE\_LTF\_FLAG is set to 1, Secure HE-LTFs as defined in 27.3.18d (Construction of Secure HE-LTF) are used in the HE-LTF Repetition Blocks, and the Packet Extension field will be partially replaced by a zero power GI in its first 1.6 μs; see Figure 27-46f (HE TB Ranging NDP format with Secure HE LTFs). The repetitions of the HE-LTF symbols are repetition of an HE-LTF Repetition Block. The randomized HE-LTF sequences are different for HE-LTF repetitions. (#**2357**)



**Figure 27-46f—HE TB Ranging NDP with Secure HE-LTFs**

**References**

[1] IEEE P802.11az™/D4.1, Draft 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 4: Enhancements for positioning