IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Comment Resolutions for Secure Ranging | | | | |
| Date: 2024-07-08 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Ali Raissinia | Qualcomm Inc. |  |  | [alirezar@qti.qualcomm.com](mailto:alirezar@qti.qualcomm.com) |
|  |  |  |  |  |

Abstract

This document provides comment resolutions to CIDs 8001, 8003, 8004, 8005, 8006, 8007, 8009, 8010, 8018, 8028, 8029, 8030, 8032, 8033 and 8035 (total of 15 CIDs) addressing technical discrepancies between various sections of the REVme D6.0 specification related to Secure Ranging.

r4 includes resolution to CIDs 8012, 8016, 8017, 8026 and 8036 (additional 5 CIDs).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Page** | **Line** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 8001 | 3165.00 |  | 12.13.7 | The L() function was changed in the baseline to ExtractBits() but the changes were not propagated to the text rolled in from 802.11az. There are two clauses where updates are required. | Change "L(" to "ExtractBits(" in the following locations: On p2751 - 3x: on lines 6,7,8 On p3165 - 3x: on lines 39, 44, 51 | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8003 | 2758.00 | 15 | 11.21.6.3.4 | Change Figure 11-68 and 11-69 so that the equation for "LTF Keyseed Generation" matches the equation in P2715L38 | As per comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8004 | 2757.00 | 18 | 11.21.6.3.4 | Modify Figure 11-68 and 11-69 so that the equation for "LTF Key Generation" matches the equation in P2755L60-61 | As per comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8005 | 2715.00 | 38 | 11.21.6.3.4 | Change "Secure HE-LTF" with "Secure LTF" in equation so that it matches the test Vector results in J.14. | As per comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8006 | 208.00 | 55 | 3.1 | Add a definition of L() used in P2756L6-9 is section 3.1 | Add the definition "L(SEQ, S, L) - It is defined as the octet sub-sequence in SEQ of length L in bits starting at position S in bits of sequence SEQ. Position starts with value of 0." | Revise  REVme TG decided to use ExtractBits() instead  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8007 | 3090.00 | 43 | 12.7.1.6.2 | Change the text "K, Label, and Context are bit strings and are represented using the ordering conventions of 9.2.2 (Conventions) " to | K, Label, and Context are octet strings. | Reject  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8009 |  |  |  | “Secure HE-LTF” and “secure HE-LTF” are used throughout. | Should they all be “Secure HE-LTF”? | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8010 |  |  |  | “secure LTF” and “secure HE-LTF” are used throughout. | Should they all be “Secure HE-LTF”, except for “Secure-LTF-Key-Seed” and “Secure-LTF-Counter”. | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8018 | 2749.00 | 43 |  | s/Secure LTF Counter/Secure HE-LTF Counter | As in comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8028 | 2755.00 | 61 | 11.21.6.4.5.4 | Change "Secure HE-LTF Expansion" with "Secure LTF Expansion" in equation so that it matches the test Vector results in J.14. | As per comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8029 | 6085.00 | 19 | J.14 | Chage "Secure HE-LTF" and "Secure HE-LTF Expansion" in J14 so that test vector results match the equations in P2715L38 and P2755L60-61 | As per comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8030 | 6085.00 |  | J.14 | Change Table in J14 to improve clarity and specify details of output block | As per comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| ####  8032 | ####### | $25.00 | 11.21.6.4.5.2 | Change the text "The STA shall discard the SAC value used in the frame exchange and shall not use the same SAC value in the current measurement exchange" to | The STA shall use a new SAC value and its corresponding ista-ltf-key and rsta-ltf-key in every other ranging measurement exchange even if the current ranging measurement exchange is unsuccessful. | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8033 | 2728.00 | 58 | 11.21.6.4.2.7 | Change the text "…which the Ack was not received, except for updating the Dialog Token field if it was nonzero, and a new Secure TRN Sequence shall be used. The Sequence Number field in the MAC header is also updated." to | which the Ack was not received, except for updating the Dialog Token field if it was nonzero, and a new Secure TRN Sequence (see 2.2.11 (EDMG Secure Ranging Sequence)), shall be used. The Sequence Number field in the MAC header is also updated. | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8035 | 2760.00 | 57 | 11.21.6.4.6 | There is a typo. Change "SRP\_AND\_NON-SRG\_OBSS-PD\_PROHIBITED" to "PRS\_AND\_NON-SRG\_OBSS-PD\_PROHIBITED" | As per comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Page** | **Line** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 8012 |  |  |  | Subclause 11.21.6.3.3, NOTE 4: The is a repeat of information provided in Clause 11.21.6.3.1 on page 2702, lines 9-16. | Delete one or justify the duplication. | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8016 | 2758.00 | 17 |  | 1. s/Secure LTF Counter/Secure HE-LTF Counter/ (to match 9.4.2.302) 2. s/Secure LTF AES Block Generator/Secure HE-LTF AES Block Generator/ 3. Add the size of the Transmitter MAC Address (A2), i.e., [6]. | As in comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8017 | 2757.00 | 29 |  | 1. s/Secure LTF Counter/Secure HE-LTF Counter/ (to match 9.4.2.302) 2. s/Secure LTF AES Block Generator/Secure HE-LTF AES Block Generator/ 3. Add the size of the Transmitter MAC Address (A2), i.e., [6]. | As in comment | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |
| 8026 | 2714.00 | 20 |  | The paragraphs at 20-25 and 27-32 are essentially duplicate. | Delete the first one. | Reject  The two paragraphs stated by commenter differs in behavior-  First paragraph describes ISTA requiring the secure LTF operation, which can occur with capable RSTA, hence a normative behavior for RSTA to honor such a request. The second paragraph allows ISTA to indicate support for secure LTF by including Secure (HE)-LTF subelement in IFTMR and based on RSTA’s local policy decides the secure LTF operation proceeds. |
| 8036 |  |  |  | Locations: P2749L43, 2754.11, Figure 11-68 Line 20, Figure 11-68 L15 and L26, L28, Figure 11-69, L16,L21, L27, L30 |  | Revise  <https://mentor.ieee.org/802.11/dcn/24/11-24-1070-04-00m-comment-resolutiona-for-secure-ranging.docx> |

Resolution for CID 8005, 8009, 8010, 8028, and 8029

**Discussion**:

11az specification included generation of Secure LTF Key Seed and SAC (Sequence Authentication Code) & LTF keys for use in the normative behavior described in section **11.21.6.4.5 Secure HE-LTF in the TB and non-TB ranging measurement exchange protocol**. It was identified that the normative text is inconsistent with the test vectors specified in section **J.14 LTF Sequence Generation Test Vectors**. The primary reason was that a general comment was added during a letter ballot review (LB) to modify the text “Secure LTF” to “Secure HE-LTF” and unfortunately the phrase “HE-“ was not used to calculate the text vectors in J.14 hence caused the discrepency. This issue was identified during the IOT testing and venders have decided to remove the phrase “HE-“ so that the test vectors is still correct. This document suggests the necessary changes to be included to the REVmeD6.0.

*Instruction to TGme Editor. Please modify the text in P2715L38 as below*

Secure-LTF-Key-Seed = HMAC-Hash(KDK, “Secure ~~HE-~~LTF key seed”)

*Instruction to TGme Editor. Please modify the text in P2755 L60-61 as below*

SAC-and-LTF-Keys = KDF-Hash-Length(Secure-LTF-Key-Seed, “Secure ~~HE-~~LTF Expansion”, Secure-LTF-Counter)

*Instruction to TGme Editor. Please modify the text in P6085 L13-45 as below*

**J.14 LTF Sequence Generation Test Vectors(11az)**

As defined in 11.21.6.3.4 (Negotiation for secure HE-LTF in the TB and non-TB ranging measurement

exchange), Secure-LTF-Key-Seed is derived from KDK as follows:

Secure-LTF-Key-Seed = HMAC-Hash(KDK, “Secure ~~HE-~~LTF key seed”)

Hash: SHA-256

KDK: 6c 7f b9 7c eb 55 b0 1a cf f0 0f 07 09 42 bd f5

29 1f eb 4b ee 38 e0 36 5b 25 a2 50 bb 2a c9 ff

Secure-LTF-Key-Seed: 07 60 6f 7b 0d 98 ca 03 ec 2d 61 e1 7c 6b df d3

0e 2f 20 30 e3 47 02 22 55 1a 05 ec 55 d1 35 b9

SAC || ista-ltf-key || rsta-ltf-key = KDF-Hash-Length(Secure-LTF-Key-Seed, “Secure ~~HE-~~LTF

Expansion”, Secure-LTF-Counter)

Hash: SHA-256

Length: 272 (bits)

Secure-LTF-Key-Seed: 07 60 6f 7b 0d 98 ca 03 ec 2d 61 e1 7c 6b df d3

0e 2f 20 30 e3 47 02 22 55 1a 05 ec 55 d1 35 b9

Secure-LTF-Counter: 0x000000000100

SAC: 23 cf

ista-ltf-key: d2 a8 a2 b7 6c 3c 29 2d 81 e1 82 a4 69 fd e8 3c

rsta-ltf-key: 65 02 7a 83 8d 58 59 3c 57 b9 41 6f 17 24 e6 c4

Transmitter MAC address: 00 10 18 32 76 54

Resolution for CID 8007 is “Reject” with following explanation-

**Discussion:** The commenter provided the comment below as part of the WFA security review

**Subclause 12.7.1.6.2, Page 3083, Line 16:** Context is defined as a bit string. The HMAC algorithm expects the input to be an octet string. Since this is specified as a library function, it needs to require that the provided bit string is a multiple of eight bits.

HMAC can generate output that converts bit-strings to octet-strings using baseline conventions stated in section 9.2.2.

Resolution for CID 8003, 8004, 8018 and 8030

**Discussion**: There are several discrepancies in text (i.e., ‘key seed’, ‘Secure-LTF-key-seed’ and ‘Secure-LTF-Counter’) with respect to the normative equations in P2715L38 and P2755L60-61 that needs to be fixed in Figure 11-68 and 11-69 in addition to adding the octet numbers for ltf-keys as well as ltf-iv. Finally the table in J.14 needs to improve to remove ambiguities so that there would be no interoperability issues with respect to implementation, specifically details of the “output block” so that the psueorandome phase rotation octets and QAM 64 symbol octet values are identified.

*TGm editor: Change Figure 11-68 as shown below:*



*TGme editor: Change Figure 11-69 as shown below:*



*TGme editor, replace the table in J.14 with table below:*

*Note to Editor: This resolution overwrites the changes were made by CID7093 that was included in the REVme D6.0.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Octet** | **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **LTF\_KEY** | d2 | a8 | a2 | b7 | 6c | 3c | 29 | 2d | 81 | e1 | 82 | a4 | 69 | fd | e8 | 3c |
| **LTF\_IV** | 00 | 10 | 18 | 32 | 76 | 54 | 00 | 00 | 00 | 00 | 01 | 00 | 00 | 00 | 00 | 00 |
| **AES counter [0]** | 00 | 10 | 18 | 32 | 76 | 54 | 00 | 00 | 00 | 00 | 01 | 00 | 00 | 00 | 00 | 00 |
| **Output block [0]** | M0,15 | M0,14 | M0.13 | M0.12 | M0,11 | M0,10 | M0,9 | M0,8 | M0,7 | M0,6 | M0,5 | M0,4 | M0,3 | M0,2 | M0,1 | M0,0 |
| aa | f6 | 2c | 30 | 6b | cd | 8a | 5d | 89 | 80 | 8b | 03 | 8e | da | 43 | f1 |
| (I,Q)=(2,5) | (I,Q)=(3,3) | (I,Q)=(1,5) | (I,Q)=(0,3) | (I,Q)=(6,5) | (I,Q)=(5,4) | (I,Q)=(2,4) | (I,Q)=(5,6) | (I,Q)=(4,4) | k=1 | k=1 | k=0 | k=1 | k=3 | k=2 | k=7 |
| **AES counter [1]** | 00 | 10 | 18 | 32 | 76 | 54 | 00 | 00 | 00 | 00 | 01 | 00 | 00 | 00 | 00 | 01 |
| **Output block [1]** | M1,15 | M1,14 | M1.13 | M1.12 | M1,11 | M1,10 | M1,9 | M1,8 | M1,7 | M1,6 | M1,5 | M1,4 | M1,3 | M1,2 | M1,1 | M1,0 |
| 54 | 15 | f0 | 5c | 7f | c7 | ee | f5 | 9b | c4 | 58 | d2 | f4 | 6b | 5b | 5a |
| (I,Q)=(1,2) | (I,Q)=(5,2) | (I,Q)=(0,3) | (I,Q)=(1,6) | (I,Q)=(7,7) | (I,Q)=(7,0) | (I,Q)=(3,5) | (I,Q)=(5,3) | (I,Q)=(6,6) | (I,Q)=(1,0) | (I,Q)=(0,6) | (I,Q)=(2,2) | (I,Q)=(1,3) | (I,Q)=(6,5) | (I,Q)=(6,6) | (I,Q)=(2,6) |
| **…**  **(I, Q) = input index for 64-QAM octet, I = input bits (B0 B1 B2), Q = input bits (B3 B4 B5) defined in Table 17-18.**  **The integer k is defined in Equation (27-131) that is used to construct the pseudorandom phase rotation. + P** | | | | | | | | | | | | | | | | |

Resolution for CID 8001 and 8006

**Discussion**: It appears that function L() is not defined in the baseline spec and it is used Figure 12-32 and in so it makes sense to add it to section 12.1 Conventions.

*TGme editor, make changes in the text P2756L6-9 as below and change Figure 12-32, Figure 12-54, P3173L62, P3174L1 and P3174L8*

SAC is equal to ~~L~~ExtractBits(SAC-and-LTF-Keys, 0, 16)

ista-ltf-key is equal to ~~L~~ExtractBits(SAC-and-LTF-Keys, 16, 128)

rsta-ltf-key is equal to ~~L~~ExtractBits(SAC-and-LTF-Keys, 144, 128)

Resolution for CID 8032

**Discussion**: The spec text needs to be clear as to when ‘SAC value’ is discarded.

*TGme editor, delete the text in P2750L25-26 and add the text below:*

~~The STA shall discard the SAC value used in the frame exchange and shall not use the same SAC value in the current measurement exchange.~~

The STA shall use a new SAC value and its corresponding ista-ltf-key and rsta-ltf-key in every ranging measurement exchange, even if the current ranging measurement exchange is unsuccessful.

Resolution for CID 8033

**Discussion**: Improve spec language by adding a reference section as to how a ‘new Secure TRN sequence” is generated.

*TGme editor, Modify the text in P2728L58-59 as below:*

which the Ack was not received, except for updating the Dialog Token field if it was nonzero, and a new Secure TRN Sequence (see 12.2.12 (EDMG Secure Ranging Sequence)), shall be used.

Resolution for CID 8035

*TGme editor, change the "SRP\_AND\_NON-SRG\_OBSS-PD\_PROHIBITED" to "PRS\_AND\_NON-SRG\_OBSS-PD\_PROHIBITED" in P2760L57 and P2761L42 as there was a typo.*

Resolution for CID 8012-

Discussion: Agree with the commenter

*TGme editor, Delete NOTE 4 in P2713L64-65 as shown below since similar text is also included in P2707L1 and 2707L6-9 shown below.*

~~NOTE 4—The PTKSA can either be established as a result of a successful association between the RSTA and ISTA; or as a result of the ISTA successfully completing PASN as described in 12.13 (Preassociation security negotiation(11az)).~~

Resolution for CID 8016, 8017 and 8036

Discussion: Contrary to what commenter suggests the ‘Secure HE-LTF Counter’ should be changed to ‘Secure LTF Counter’ to make it consistatnt with normative text as well as J.14 test vectors in addition to proposed resolution for CIDs 8005, 8009, 8010, 8028, and 8029 AND proposed resolution for CIDs 8003, 8004, 8018 and 8030 included in this document (i.e. 802.11-24/1070). Also, there is no need to change the ‘Secure LTF AES Block Generator’ to ‘Secure HE-LTF AES Block Genrator’ since the ‘HE-“ is being deleted.

*TGme editor, Change ‘Secure HE-LTF Counter’ with ‘Secure LTF Counter’ in Figure 9-1049 in P1551L58, P1551L64 and the text in P1552L4, P1552L14, P1552L17, P2714L59, P2715L33, P2715L55, P2746L57, P2746L58, P2746L60, P2748L15, P2749L21, P2753L7, P2753L25, P2753L56, P2756L22, P2756L28, P2756L43, P2757L53, P2758L55, P2759L1, P2759L6, P2759L8, and P2759L10.*

**References: P802.11REVme D6.0**