**3GPP TSG-CT WG1 Meeting #125-eC1-20xxxx**

**Electronic meeting, 20-28 August 2020 (was 205003)**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **24.587** | **CR** | 0098 | **rev** | **1** | **Current version:** | **16.1.1** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:***  | Indication of security protection activation |
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| ***Source to WG:*** | Qualcomm Incorporated |
| ***Source to TSG:*** | C1 |
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| ***Work item code:*** | eV2XARC |  | ***Date:*** | 2020-07-24 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | According to LS R2-2005978 (waiting for CT1 tdoc number), RAN2 would like to request SA3 and CT1 to support an indication for the initiation of security activation and the change of the key due to re-keying procedure.Security protection of PC5 unicast signalling and PC5 unicast user plane are optional. When the security protection is not activated for the PC5 unicast link, lower layer does not have to perform security protection. Therefore, two explicit indications are required to lower layer:* Security protection activation/deactivation on PC5 unicast signalling
* Security protection activation/deactivation on PC5 unicast user plane

According to RAN2 agreement on R2-2001668, 4 different LCIDs are allocated for the following SL SRBs:i) The PC5-S signalling that is not protected, e.g., Direct Communication Request.ii) The PC5-S signalling to activate security, i.e., Direct Security Mode Command and Direct Security Mode Complete.iii) Other PC5-S signallings that are protected.iv) PC5-RRC signallings that are protected.Until the AS layer gets an indication that security has been turned ‘Activated’, it can assume that all PC5-S messages are unprotected, except the Security Mode Command and the Security Mode Complete which are for security activation. After the activation of security protection, all PC5-S msgs are treated as iii).For ii), there are only two PC5-S signalling (Direct Securit Mode Command and Direct Security Mode Complete), therefore, PC5-S message type itself can identify the PC5-S msg is for ii), which does not need an explicit indication.Please note that the security protection is applied per PC5 unicast link. Once the security protection is activated for the PC5 unicast link, lower layer applies the security protection for the PC5 unicast link until V2X layer indicates otherwise or the PC5 unicast link is released.When the security protection is activated, V2X layer needs to provide lower layer with the security materials (e.g., selected algorithms, security keys) to indicate security protection activation.An explicit indication for key change due to re-keying procedure is not necessary because Direct SMC procedure shall take place and the indication with new security material shall be provided to lower layer after the completion of direct SMC procedure. PDCP layer can take this information into account to re-establish PDCP entity with new security keys.V2X layer needs to provide integrity protection key and the chosen alg to the lower layer when it inititates PC5 Security Mode Command, as this message shall be integrity protected. |
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| ***Summary of change:*** | When UE initiates Direct Link Security Mode Command, the UE provides integrity protection key and the chosen algorithm to lower layer.After DIRECT LINK SMC procedure, the UE provides the security materials as specified in TS 33.536 lower layer to indicate security protection activation.  |
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| ***Consequences if not approved:*** | Lower layer cannot know whether security protection for the PC5 unicast link is necessary or not. |
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| ***Clauses affected:*** | ~~6.1.2.2.2,~~ 6.1.2.7.2, 6.1.2.7.3, 6.1.2.7.4 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Changes on 6.1.2.2.2 was removed.Adding changes on 6.1.2.7.2 to provide NRIPK and the chosen algorithm to the lower layer |

\*\*\*\*\* First change \*\*\*\*\*

##### 6.1.2.7.2 PC5 unicast link security mode control procedure initiation by the initiating UE

The initiating UE shall meet the following pre-conditions before initiating the PC5 unicast link security mode control procedure:

a) the target UE has initiated a PC5 unicast link establishment procedure toward the initiating UE by sending a DIRECT LINK ESTABLISHMENT REQUEST message and:

1) the DIRECT LINK ESTABLISHMENT REQUEST message:

i) includes a target user info IE which includes the application layer ID of the initiating UE; or

ii) does not include a target user info IE and the initiating UE is interested in the V2X service identified by the V2X service identifier in the DIRECT LINK ESTABLISHMENT REQUEST message; and

2) the initiating UE has either identified an existing KNRP based on the KNRP ID included in the DIRECT LINK ESTABLISHMENT REQUEST message or derived a new KNRP; or

b) the target UE has initiated a PC5 unicast link re-keying procedure toward the initiating UE by sending a DIRECT LINK REKEYING REQUEST message and:

1) if the target UE has included a Re-authentication indication in the DIRECT LINK REKEYING REQUEST message, the initiating UE has derived a new KNRP.

If a new KNRP has been derived by the initiating UE, the initiating UE shall generate the 16 MSBs of KNRP ID to ensure that the resultant KNRP ID will be unique in the initiating UE.

The initiating UE shall select security algorithms in accordance with its UE PC5 unicast signalling security policy and the target UE’s PC5 unicast signalling security policy. If the PC5 unicast link security mode control procedure was triggered during a PC5 unicast link establishment procedure, the initiating UE shall not select the null integrity protection algorithm if the initiating UE or the target UE’s PC5 unicast signalling integrity protection policy is set to "signalling integrity protection required". If the PC5 unicast link security mode control procedure was triggered during a PC5 unicast link re-keying procedure, the initiating UE shall not select the null integrity protection algorithm if the integrity protection algorithm currently in use for the PC5 unicast link is different from the null integrity protection algorithm.

Then the initiating UE shall:

a) generate a 128-bit Nonce\_2 value;

b) derive KNRP-sess from KNRP, Nonce\_2 and Nonce\_1 received in the DIRECT LINK ESTABLISHMENT REQUEST message as specified in 3GPP TS 33.536 [20];

c) derive the NR PC5 encryption key NRPEK and the NR PC5 integrity key NRPIK from KNRP-sess and the selected security algorithms as specified in 3GPP TS 33.536 [20], and

d) create a DIRECT LINK SECURITY MODE COMMAND message. In this message, the initiating UE:

1) shall include the Key establishment information container if a new KNRP has been derived at the initiating UE and the authentication method used to generate KNRP requires sending information to complete the authentication procedure;

NOTE: The Key establishment information container is provided by upper layers.

2) shall include the MSBs of KNRP ID if a new KNRP has been derived at the initiating UE;

3) shall include a Nonce\_2 set to the 128-bit nonce value generated by the initiating UE for the purpose of session key establishment over this PC5 unicast link if the selected integrity protection algorithms is not the null integrity protection algorithm;

4) shall include the selected security algorithms;

5) shall include the UE security capabilities received from the target UE in the DIRECT LINK ESTABLISHMENT REQUEST message or DIRECT LINK REKEYING REQUEST message;

6) shall include the UE PC5 unicast signalling security policy received from the target UE in the DIRECT LINK ESTABLISHMENT REQUEST message or DIRECT LINK REKEYING REQUEST message;

7) shall include the 8 LSBs of KNPR-sess ID chosen by the initiating UE as specified in 3GPP TS 33.536 [20] if the selected integrity protection algorithms is not the null integrity protection algorithm.

The initiating UE shall form the KNPR-sess ID from the 8 MSBs of KNPR-sess ID received in the DIRECT LINK ESTABLISHMENT REQUEST message or DIRECT LINK REKEYING REQUEST message and the 8 LSBs of KNPR-sess ID included in the DIRECT LINK SECURITY MODE COMMAND message.

The initiating UE shall not cipher the DIRECT LINK SECURITY MODE COMMAND message but shall integrity protect it with the new security context.

After the DIRECT LINK SECURITY MODE COMMAND message is generated, the initiating UE shall pass this message to the lower layers for transmission along with the initiating UE's layer-2 ID for unicast communication and the target UE's layer-2 ID for unicast communication, and start timer T5007. The UE shall not send a new DIRECT LINK SECURITY MODE COMMAND message to the same target UE while timer T5007 is running. The initiating UE shall provide lower layer with NRPIK and the selected security algorithm as specified in TS 33.536 [20].



\*\*\*\*\* Second change \*\*\*\*\*

##### 6.1.2.7.3 PC5 unicast link security mode control procedure accepted by the target UE

Upon receipt of a DIRECT LINK SECURITY MODE COMMAND message, if the PC5 unicast link security mode control procedure was triggered during a PC5 unicast link establishment procedure, the target UE shall check that the 8 LSBs of KNPR-sess ID included in the DIRECT LINK SECURITY MODE COMMAND message are not set to the same value as those received from another UE in response to the target UE’s DIRECT LINK ESTABLISHMENT REQUEST message.

Then the target UE shall:

a) derive KNRP-sess from KNRP, Nonce\_1 and Nonce\_2 received in the DIRECT LINK SECURITY MODE COMMAND message as specified in 3GPP TS 33.536 [20]; and

b) derive NRPEK and NRPIK from KNRP-sess and the selected security algorithms as specified in 3GPP TS 33.536 [20].

The target UE shall determine whether or not the DIRECT LINK SECURITY MODE COMMAND message can be accepted by:

a) checking the integrity of the DIRECT LINK SECURITY MODE COMMAND message using NRPIK;

b) checking that the received UE security capabilities have not been altered compared to the values that the target UE sent to the initiating UE in the DIRECT LINK ESTABLISHMENT REQUEST message or DIRECT LINK REKEYING REQUEST message;

c) if the PC5 unicast link security mode control procedure was triggered during a PC5 unicast link establishment procedure,

1) checking that the received UE PC5 unicast signalling security policy has not been altered compared to the values that the target UE sent to the initiating UE in the DIRECT LINK ESTABLISHMENT REQUEST message; and

2) checking that the selected security algorithms in the DIRECT LINK SECURITY MODE COMMAND message do not include the null integrity protection algorithm if the target UE’s PC5 unicast signalling integrity protection policy is set to "signalling integrity protection required"; and

d) if the PC5 unicast link security mode control procedure was triggered during a PC5 unicast link re-keying procedure and the integrity protection algorithm currently in use for the PC5 unicast link is different from the null integrity protection algorithm, checking that the selected security algorithms in the DIRECT LINK SECURITY MODE COMMAND message do not include the null integrity protection algorithm.

If the target UE did not include a KNRP ID in the DIRECT LINK ESTABLISHMENT REQUEST message, the target UE included a Re-authentication indication in the DIRECT LINK REKEYING REQUEST message or the initiating UE has chosen to derive a new KNRP, the target UE shall derive KNRP as specified in 3GPP TS 33.536 [20]. The target UE shall choose the 16 LSBs of KNRP ID to ensure that the resultant KNRP ID will be unique in the target UE. The target UE shall form KNRP ID from the received MSBs of KNRP ID and its chosen LSBs of KNRP ID and shall store the complete KNRP ID with KNRP.

If the target UE accepts the DIRECT LINK SECURITY MODE COMMAND message, the target UE shall create a DIRECT LINK SECURITY MODE COMPLETE message. In this message, the target UE:

a) shall include the PQFI and the corresponding PC5 QoS parameters;

b) if IP communication is used, shall include an IP address configuration IE set to one of the following values:

1) "IPv6 router" if IPv6 address allocation mechanism is supported by the target UE, i.e. acting as an IPv6 router; or

2) "IPv6 address allocation not supported" if IPv6 address allocation mechanism is not supported by the target UE;

c) if IP communication is used and the IP address configuration IE is set to "IPv6 address allocation not supported", shall include a link local IPv6 address IE formed locally based on IETF RFC 4862 [6];

d) if a new KNRP was derived, shall include the 16 LSBs of KNRP ID; and

e) if the PC5 unicast link security mode control procedure was triggered during a PC5 unicast link establishment procedure, shall include its UE PC5 unicast user plane security policy for this PC5 unicast link.

The target UE shall form the KNPR-sess ID from the 8 MSBs of KNPR-sess ID it had sent in the DIRECT LINK ESTABLISHMENT REQUEST message or DIRECT LINK REKEYING REQUEST message and the 8 LSBs of KNPR-sess ID received in the DIRECT LINK SECURITY MODE COMMAND message.

The target UE shall cipher and integrity protect the DIRECT LINK SECURITY MODE COMPLETE message with the new security context.

After the DIRECT LINK SECURITY MODE COMPLETE message is generated, the target UE shall pass this message to the lower layers for transmission along with the target UE's layer-2 ID for unicast communication and the initiating UE's layer-2 ID for unicast communication. The target UE shall provide lower layer with NRPEK, NRPIK, KNPR-sess ID and the selected security algorithms as specified in TS 33.536 [20] to indicate the PC5 unicast signalling security protection and/or PC5 unicast user plane security protection for the PC5 unicast link.\*\*\*\*\* Third change \*\*\*\*\*

##### 6.1.2.7.4 PC5 unicast link security mode control procedure completion by the initiating UE

Upon receiving a DIRECT LINK SECURITY MODE COMPLETE message, the initiating UE shall stop timer T5007 and check the integrity of the DIRECT LINK SECURITY MODE COMPLETE message. If the integrity check passes, the initiating UE shall then continue the procedure which triggered the PC5 unicast link security mode control procedure. The initiating UE shall provide lower layer with NRPEK, NRPIK, KNPR-sess ID and the selected security algorithms as specified in TS 33.536 [20] to indicate the PC5 unicast signalling security protection and/or PC5 unicast user plane security protection for the PC5 unicast link.