**3GPP TSG-CT WG1 Meeting #141eC1-232205**

**Online 17– 21 April 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **54** | **CR** | **0292** | **rev** | **-** | **Current version:** |  |  |
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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:***  | U2U link establishment with integrated discovery |
|  |  |
| ***Source to WG:*** | Interdigital |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | 5G\_ProSe\_Ph2 |  | ***Date:*** | 2023-04-10 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | The 5G ProSe UE-to-UE relay link establishment is introduced to TS 23.304 v18.0.0 and later is updated in SA2#154AH (S2-2301479).The corresponding stage 3 implementation is needed.For link establishment, there are two kinds of procedures, i.e. with or without integrated discovery.This CR focus on the link establishment with integrated discovery. |
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| ***Summary of change:*** | Add the link establishment with integrated discovery for UE-to-UE relay. |
|  |  |
| ***Consequences if not approved:*** | U2U link establishment with integrated discovery is missing. |
|  |  |
| ***Clauses affected:*** | 7.2.2.2, 7.2.2.5, 11.3.8 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 23.304 CR 0172  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\*\*\*\*\* Start change \*\*\*\*\*

#### 7.2.2.2 5G ProSe direct link establishment procedure initiation by initiating UE

The initiating UE shall meet the following pre-conditions before initiating this procedure:

a) a request from upper layers to transmit the packet for ProSe application over PC5 or a request from lower layers to trigger ProSe direct link establishment;

b) the communication mode is unicast mode (e.g., pre-configured as specified in clause 5.2.4 or indicated by upper layers);

c) the link layer identifier for the initiating UE (i.e., layer-2 ID used for unicast communication) is available (e.g., pre-configured or self-assigned) and is not being used by other existing 5G ProSe direct links within the initiating UE;

d) the link layer identifier for the destination UE (i.e., the unicast layer-2 ID of the target UE or the broadcast layer-2 ID) is available to the initiating UE (e.g., pre-configured, obtained as specified in clause 5.2, known via prior ProSe direct communication or indicated by lower layers);

NOTE 1: In the case where different ProSe applications are mapped to distinct default destination layer-2 IDs, when the initiating UE intends to establish a single unicast link that can be used for more than one ProSe identifiers, the UE can select any of the default destination layer-2 ID for unicast initial signalling.

e) the initiating UE is either authorised for 5G ProSe direct communication over PC5 in NR-PC5 in the serving PLMN, has a valid authorization for 5G ProSe direct communication over PC5 in NR-PC5 when not served by NG-RAN, is authorized to use a 5G ProSe UE-to-network relay UE, is authorized to use a 5G ProSe UE-to-UE relay UE or is authorized to act as a 5G ProSe UE-to-UE relay UE. The UE considers that it is not served by NG-RAN if the following conditions are met:

1) not served by NG-RAN for ProSe direct communication over PC5;

2) in limited service state as specified in 3GPP TS 23.122 [14], if the reason for the UE being in limited service state is one of the following;

i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [15];

ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [11]; or

iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed" as specified in 3GPP TS 24.501 [11]; or

3) in limited service state as specified in 3GPP TS 23.122 [14] for reasons other than i), ii) or iii) above and located in a geographical area for which the UE is provisioned with "non-operator managed" radio parameters as specified in clause 5.2;

Editor's note: The UE behavior in limited service state if the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE needs to be revisited, which will be determined by SA2.

f) there is no existing 5G ProSe direct link for the pair of peer application layer IDs, or there is an existing 5G ProSe direct link for the pair of peer application layer IDs and:

1) the network layer protocol of the existing 5G ProSe direct link is not identical to the network layer protocol required by the upper layer in the initiating UE for this ProSe application;

2) the security policy (either signalling security policy or user plane security policy) corresponding to the ProSe identifier is not compatible with the security policy of the existing 5G ProSe direct link; or

3) in case of the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe layer-3 remote UE and the 5G ProSe layer-3 UE-to-network relay UE, the existing 5G ProSe direct link for the peer UE is established with a different RSC or established not for direct communication between the 5G ProSe layer-3 remote UE and the 5G ProSe layer-3 UE-to-network relay UE;

4) in case of the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe layer-2 remote UE and the 5G ProSe layer-2 UE-to-network relay UE, the existing 5G ProSe direct link for the peer UE is established not for direct communication between the 5G ProSe layer-2 remote UE and the 5G ProSe layer-2 UE-to-network relay UE; or

5) in case of the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe layer-3 end UE and the 5G ProSe layer-3 UE-to-UE relay UE, the existing 5G ProSe direct link for the peer UE is established with a different RSC or established not for direct communication between the 5G ProSe layer-3 end UE and the 5G ProSe layer-3 UE-to-UE relay UE;

g) the number of established 5G ProSe direct links is less than the implementation-specific maximum number of established 5G ProSe direct links allowed in the UE at a time;

h) timer T5088 is not associated with the link layer identifier for the destination UE or timer T5088 associated with the link layer identifier for the destination UE has already expired or stopped;

i) the relay indication is included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message if the initiating UE is acting as the source 5G ProSe end UE and the 5G ProSe direct link establishment procedure is for direct communication between the source 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE.

After receiving the service data or request from the upper layers, the initiating UE shall derive the PC5 QoS parameters and assign the PQFI(s) for the PC5 QoS flows(s) to be established as specified in clause 7.2.7.

If the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, then the UE shall apply the DUCK or DUSK with the associated encrypted bitmask used for UE-to-network relay discovery along with the UTC-based counter for encrypting:

a) the relay service code; and

b) the UP-PRUK ID or CP-PRUK ID, if available,

as specified in clause 6.3.5.2 of 3GPP TS 33.503 [34], and the UE shall use the security protected relay service code and the security protected UP-PRUK ID or security protected CP-PRUK ID for creating a PROSE DIRECT LINK ESTABLISHMENT REQUEST message.

NOTE 2: If the UE is neither configured with DUCK nor DUSK, the relay service code and the UP-PRUK ID or CP-PRUK ID are not encrypted.

If the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe UE-to-UE relay UE and the target 5G ProSe end UE, upon receiving a PROSE DIRECT LINK ESTABLISHMENT REQUEST message using integrated discovery (i.e. with destination L2 ID set to broadcast value as specified in clause 5.2.4), the initiating UE acting as the 5G ProSe UE-to-UE relay UE initiates the 5G ProSe direct link establishment procedure or the 5G ProSe direct link modification procedure to the target 5G ProSe end UE. The 5G ProSe direct link establishment procedure is used if there is no existing 5G ProSe direct link established between the initiating UE and the target UE or if no target user info is specified in the 5G ProSe direct link establishment request.

If the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe UE-to-UE relay UE and the target 5G ProSe end UE, without integrated discovery, upon successful completion of the 5G ProSe direct link security mode control procedure with the source 5G ProSe end UE, the initiating UE acting as the 5G ProSe UE-to-UE relay UE initiates the 5G ProSe direct link establishment procedure to the target 5G ProSe end UE.

Editor’s note: When the direct link modification procedure can be used between the 5G ProSe UE-to-UE relay UE and the target 5G ProSe end UE is FFS.

In order to initiate the 5G ProSe direct link establishment procedure, the initiating UE shall create a PROSE DIRECT LINK ESTABLISHMENT REQUEST message. The initiating UE:

a) shall include the source user info set to the initiating UE's application layer ID received from upper layers, or set to the user info ID of the source 5G ProSe end UE if the 5G ProSe direct link establishment procedure is for 5G ProSe direct communication between the 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE;

b) shall include the ProSe identifier(s) received from upper layer if the 5G ProSe direct link establishment procedure is not for 5G ProSe direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE;

c) shall include the target user info set to the target UE's application layer ID if received from upper layers or if known based on the unicast layer-2 ID of target UE (i.e. destination layer-2 ID) as described in clause 5.8.2.4 of 3GPP TS 23.304 [3], to the user info ID of the 5G ProSe UE-to-network relay UE obtained during the 5G ProSe UE-to-network relay discovery procedure, or to the user info ID of the target 5G ProSe end UE:

1) if the initiating UE is acting as the source 5G ProSe end UE and the user info ID of the target 5G ProSe end UE is obtained during the 5G ProSe UE-to-UE relay discovery procedure; or

2) if the initiating UE is acting as the 5G ProSe UE-to-UE relay UE and the user info ID of the target 5G ProSe end UE is obtained in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message from the source 5G ProSe end UE;

ca) shall include the UE-to-UE relay UE user info set to the user info ID of the 5G ProSe UE-to-UE relay UE:

1) if obtained during the 5G ProSe UE-to-UE relay discovery procedure and the 5G ProSe direct link establishment procedure is for 5G ProSe direct communication between the source 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE; or

2) configured as specified in clause 5.2.7 if the initiating UE is acting as the 5G ProSe UE-to-UE relay UE;

cb) shall include the target end UE layer-2 ID set to the layer-2 ID of the target 5G ProSe end UE if available in the source 5G ProSe end UE via the previous direct communication;

d) if the 5G ProSe direct link is not for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE:

1) shall include the key establishment information container if the UE PC5 unicast signalling integrity protection policy is set to "Signalling integrity protection required" or "Signalling integrity protection preferred" and may include the key establishment information container if the UE PC5 unicast signalling integrity protection policy is set to "Signalling integrity protection not needed";

NOTE 3: The key establishment information container is provided by upper layers.

e) shall include:

1) a Nonce\_1, if the direct communication is not between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, or if the direct communication is between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE and the security procedure over control plane is used as specified in 3GPP TS 33.503 [34]; or

2) a KNRP freshness parameter 1, if the direct communication is between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE and the security procedure over user plane is used as specified in 3GPP TS 33.503 [34];

 set to the 128-bit nonce value generated by the initiating UE for the purpose of session key establishment over this 5G ProSe direct link if the UE PC5 unicast signalling integrity protection policy is set to "Signalling integrity protection required" or "Signalling integrity protection preferred";

NOTE 4: The Nonce\_1 IE in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message is used to hold the value of Nonce\_1 or KNRP freshness parameter 1.

f) shall include its UE security capabilities indicating the list of algorithms that the initiating UE supports for the security establishment of this 5G ProSe direct link;

g) shall include the MSB of KNRP-sess ID chosen by the initiating UE as specified in 3GPP TS 33.503 [34] if the UE PC5 unicast signalling integrity protection policy is set to "Signalling integrity protection required" or "Signalling integrity protection preferred";

NOTE 5: If the direct communication is not between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, the KNRP-sess ID holds the ID that corresponds to KNRP-sess. If the direct communication is between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, the KNRP-sess ID holds the ID that corresponds to KNRP-sess (if security procedure over user plane is used) or Krelay-sess (if security procedure over control plane is used).

h) may include a KNRP ID if the initiating UE has an existing KNRP for the target UE and the direct communication is not between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE;

i) shall include its UE PC5 unicast signalling security policy. In the case where the different ProSe applications are mapped to the different PC5 unicast signalling security policies, when the initiating UE intends to establish a single unicast link that can be used for more than one ProSe application, each of the signalling security polices of those ProSe applications shall be compatible, e.g., "Signalling integrity protection not needed" and "Signalling integrity protection required" are not compatible. In case the 5G ProSe direct link establishment procedure is for direct communication between 5G ProSe remote UE and 5G ProSe UE-to-network relay UE, the Signalling integrity protection policy shall be set to "Signalling integrity protection required";

j) shall include the Relay service code IE set to the relay service code of the target relay UE if the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, or to the relay service code indicating the connectivity service requested by the source 5G ProSe end UE if the 5G ProSe direct link establishment procedure is for direct communication between the (source or target) 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE;

k) shall include the UTC-based counter LSB set to the four least significant bits of the UTC-based counter if the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE;

l) shall include the UE identity IE set to the SUCI of the initiating UE if:

1) the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE; and

2) the security for 5G ProSe UE-to-network relay uses the security procedure over control plane and the initiating UE does not have a valid CP-PRUK as specified in 3GPP TS 33.503 [34], or, the security for 5G ProSe UE-to-network relay uses the security procedure over user plane and the initiating UE does not have a valid UP-PRUK as specified in 3GPP TS 33.503 [34];

m) shall include the User security key ID IE set to:

1) UP-PRUK ID of the initiating UE if:

i) the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE;

ii) the initiating UE has a valid UP-PRUK; and

iii) the security for 5G ProSe UE-to-network relay uses the security procedure over user plane as specified in 3GPP TS 33.503 [34]; or

2) CP-PRUK ID of the initiating UE that is associated with the relay service code of the target UE if:

i) the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE;

ii) the initiating UE has a valid CP-PRUK is associated with the relay service code of the target UE; and

iii) the security for 5G ProSe UE-to-network relay uses the security procedure over control plane as specified in 3GPP TS 33.503 [34];

n) shall include the HPLMN ID of the initiating UE, if the UP-PRUK ID of the initiating UE is included and is not in NAI format (see 3GPP TS 33.503 [34]);

o) shall include the MIC IE set to the calculated MIC value as specified in clause 6.3.5.3 of 3GPP TS 33.503 [34] if the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE and the UE has the DUIK; and

p) shall include the relay indication which indicates that the PROSE DIRECT LINK ESTABLISHMENT REQUEST message can be forwarded by a 5G ProSe UE-to-UE relay UE, if the 5G ProSe direct link establishment procedure is for direct communication between the source 5G ProSe end UE and 5G ProSe UE-to-UE relay UE with integrated discovery;

Editor’s note: The security parameters for 5G ProSe UE-to-UE relay and the parameters for 5G ProSe layer-2 UE-to-UE relay are FFS.

After the PROSE DIRECT LINK ESTABLISHMENT REQUEST message is generated, the initiating UE shall pass this message to the lower layers for transmission along with the source layer-2 ID and destination layer-2 ID as follows:

a) if the 5G ProSe direct communication is in a consequence of 5G ProSe direct discovery as defined in clause 6.2.14, clause 6.2.15, clause 8.2.1, and clause 8a.2.1:

 self-assign a source layer-2 ID, and

1) the destination layer-2 ID set to the received target end UE layer-2 ID in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message if the initiating UE is acting as the 5G ProSe UE-to-UE relay UE;

2) otherwise, the destination layer-2 ID set to the source layer-2 ID in the received PROSE PC5 DISCOVERY message for discovery procedure;

b) if the initiating UE is acting as the source 5G ProSe end UE and the 5G ProSe direct link establishment procedure is for direct communication between the source 5G ProSe end UE and 5G ProSe UE-to-UE relay UE with integrated discovery:

 self-assign a source layer-2 ID, and the destination layer-2 ID set to the broadcast destination layer-2 ID configured as specified in clause 5.2.4; or

c) if the initiating UE is acting as the 5G ProSe UE-to-UE relay UE and the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe UE-to-UE relay UE and target 5G ProSe end UE with integrated discovery:

 self-assign a source layer-2 ID, and the destination layer-2 ID set to:

1) the target end UE layer-2 ID, if received in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message from the source 5G ProSe end UE; otherwise

2) the broadcast destination layer-2 ID configured as specified in clause 5.2.4; or

c) otherwise:

 self-assign a source layer-2 ID, and the destination layer-2 ID set to the destination layer-2 ID used for unicast initial signalling as specified in clause 5.2.4,

NOTE 6: The UE implementation ensures that any value of the self-assigned source layer-2 ID in a) and b) is different from any other self-assigned source layer-2 ID(s) in use for 5G ProSe direct discovery as specified in clause 6.2.14, clause 6.2.15 and clause 8.2.1, and is different from any other provisioned destination layer-2 ID(s) as specified in clause 5.2.

NOTE 7: It is possible for the initiating UE to reuse the initiating UE's layer-2 ID used in previous 5G ProSe direct link with the same peer UE.

and start timer T5080.

NOTE 8: A default PC5 DRX configuration is used for transmitting the PROSE DIRECT LINK ESTABLISHMENT REQUEST message as specified in 3GPP TS 38.300 [21].

The UE shall not send a new PROSE DIRECT LINK ESTABLISHMENT REQUEST message to the same target UE identified by the same application layer ID while timer T5080 is running. If the target user info IE is not included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message (i.e., ProSe application oriented 5G ProSe direct link establishment procedure), the initiating UE shall handle multiple PROSE DIRECT LINK ESTABLISHMENT ACCEPT messages, if any, received from different target UEs for the establishment of multiple 5G ProSe direct links before the expiry of timer T5080.

NOTE 9: In order to ensure successful 5G ProSe direct link establishment, T5080 should be set to a value larger than the sum of T5089 and T5092.



Figure 7.2.2.2.1: UE oriented 5G ProSe direct link establishment procedure



Figure 7.2.2.2.2: ProSe service oriented 5G ProSe direct link establishment procedure

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#### 7.2.2.3 5G ProSe direct link establishment procedure accepted by the target UE

Upon receipt of a PROSE DIRECT LINK ESTABLISHMENT REQUEST message, if the target UE accepts this request, the target UE shall uniquely assign a PC5 link identifier, create a 5G ProSe direct link context.

NOTE 1: A default PC5 DRX configuration is used for receiving the PROSE DIRECT LINK ESTABLISHMENT REQUEST message as specified in 3GPP TS 38.300 [21].

If the PROSE DIRECT LINK ESTABLISHMENT REQUEST message is for 5G ProSe direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, the target UE shall verify the MIC field in the received PROSE DIRECT LINK ESTABLISHMENT REQUEST with the DUIK, if any, and decrypts the encrypted:

a) relay service code; and

b) UP-PRUK ID or CP-PRUK ID, if received,

using the DUCK, or DUSK with the associated encrypted bitmask used for 5G ProSe UE-to-network relay discovery (see clause 6.3.5.2 of 3GPP TS 33.503 [34]) and verifies if the relay service code matches with the one that the target UE has sent during 5G ProSe UE-to-network relay discovery procedure.

NOTE 2: If the UE is neither configured with DUCK nor DUSK, the relay service code and the UP-PRUK ID or CP-PRUK ID are not encrypted.

If the target UE is acting as the target 5G ProSe end UE and the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe UE-to-UE relay UE and target 5G ProSe end UE with integrated discovery, upon receipt of the PROSE DIRECT LINK ESTABLISHMENT REQUEST messages which contains the same source user info, ProSe identifier(s) and relay service code as received from multiple 5G ProSe UE-to-UE relay UEs, the target UE selects one of the 5G ProSe UE-to-UE relay UEs via which to communicate with the source 5G ProSe end UE as specified in clause 5.2.7.

If the 5G ProSe direct link establishment procedure is not for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, the target UE may initiate 5G ProSe direct link authentication procedure as specified in clause 7.2.12 and shall initiate 5G ProSe direct link security mode control procedure as specified in clause 7.2.10.

If the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE, the target UE shall proceed with either:

a) the authentication and key agreement procedure as specified in clause 5.5.4 of 3GPP TS 24.501 [11] if the security procedure over control plane as specified in 3GPP TS 33.503 [34] is used; or

b) the key request procedure as specified in clause 8.2.10.2.4 if the security procedure over user plane as specified in 3GPP TS 33.503 [34] is used;

and shall initiate 5G ProSe direct link security mode control procedure as specified in clause 7.2.10.

The target UE shall set the source layer-2 ID and the destination layer-2 ID as specified in clause 7.2.12 and clause 7.2.10, and store the corresponding source layer-2 ID for unicast communication and the destination layer-2 ID for unicast communication in the 5G ProSe direct link context.

If:

a) the target user info IE is included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message and this IE includes the target UE's application layer ID; or

b) the target user info IE is not included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message and the target UE is interested in the ProSe application(s) identified by the ProSe identifier IE in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message;

then the target UE shall:

a) if the direct communication is not between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE:

1) identify an existing KNRP based on the KNRP ID included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message; or

2) if KNRP ID is not included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message, the target UE does not have an existing KNRP for the KNRP ID included in PROSE DIRECT LINK ESTABLISHMENT REQUEST message or the target UE wishes to derive a new KNRP, derive a new KNRP. This may require performing one or more 5G ProSe direct link authentication procedures as specified in clause 7.2.12;

b) if the direct communication is between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE and the security procedure over control plane as specified in 3GPP TS 33.503 [34] is used, request a new KNR\_ProSe according to the security procedure over user plane as specified in 3GPP TS 33.503 [34]; or

c) if the direct communication is between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE and the security procedure over user plane as specified in 3GPP TS 33.503 [34] is used, request a new KNRP according to the security procedure over user plane.

NOTE 3: How many times the 5G ProSe direct link authentication procedure needs to be performed to derive a new KNRP depends on the authentication method used.

After an existing KNRP was identified or a new KNRP was derived, or after a new KNRP or KNR\_ProSe is received, the target UE shall initiate a 5G ProSe direct link security mode control procedure as specified in clause 7.2.10.

Upon successful completion of the 5G ProSe direct link security mode control procedure, in order to determine whether the PROSE DIRECT LINK ESTABLISHMENT REQUEST message can be accepted or not, in case of IP communication, the target UE checks whether there is at least one common IP address configuration option supported by both the initiating UE and the target UE.

Before sending the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message to the 5G ProSe remote UE, the target UE acting as a 5G ProSe layer-3 UE-to-network relay UE initiates the UE requested PDU session establishment procedure as specified in 3GPP TS 24.501 [11] if:

1) the PDU session for relaying the service associated with the RSC has not been established yet; or

2) the PDU session for relaying the service associated with the RSC has been established but the PDU session type is Unstructured.

If the target UE accepts the 5G ProSe direct link establishment procedure, the target UE shall create a PROSE DIRECT LINK ESTABLISHMENT ACCEPT message. The target UE:

a) shall include the source user info set to the target UE's application layer ID received from upper layers, or set to the user info ID of the target 5G ProSe end UE if the 5G ProSe direct link establishment procedure is for 5G ProSe direct communication between the 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE;

aa) shall include the UE-to-UE relay UE user info set to the user info ID of the 5G ProSe UE-to-UE relay UE if the 5G ProSe direct link establishment procedure is for 5G ProSe direct communication between the source 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE;b) shall include PQFI(s), the corresponding PC5 QoS parameters and optionally the ProSe identifier(s) that the target UE accepts, if the target UE is not acting as a 5G ProSe layer-2 UE-to-network relay UE and the 5G ProSe direct link establishment procedure is not with integrated discovery and not for 5G ProSe direct communication between the target 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE;

c) may include the PC5 QoS rule(s) if the target UE is not acting as a 5G ProSe layer-2 UE-to-network relay UE and the 5G ProSe direct link establishment procedure is not with integrated discovery and not for 5G ProSe direct communication between the target 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE;

Editor's note: It is FFS how to forward the PC5 QoS parameters and the PQFI(s) for the PC5 QoS flow(s) between the 5G ProSe layer-3 UE-to-UE relay UE and the 5G ProSe layer-3 end UE.

d) shall include an IP address configuration IE set to one of the following values if IP communication is used and the target UE is not acting as a 5G ProSe layer-2 UE-to-network relay UE:

1) "DHCPv4 server" if only IPv4 address allocation mechanism is supported by the target UE, i.e., acting as a DHCPv4 server;

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

3) "DHCPv4 server & IPv6 Router" if both IPv4 and IPv6 address allocation mechanism are supported by the target UE; or

4) "address allocation not supported" if neither IPv4 nor IPv6 address allocation mechanism is supported by the target UE and the target UE is not acting as a 5G ProSe layer-3 UE-to-network relay UE;

NOTE 4: The UE doesn't include an IP address configuration IE nor a link local IPv6 address IE if Ethernet or Unstructured data unit type is used for communication.

e) shall include a link local IPv6 address IE formed locally based on IETF RFC 4862 [25] if IP address configuration IE is set to "address allocation not supported", the received PROSE DIRECT LINK SECURITY MODE COMPLETE message included a link local IPv6 address IE and the target UE is neither acting as a 5G ProSe layer-2 UE-to-network relay UE nor acting as a 5G ProSe layer-3 relay UE; and

f) shall include the configuration of UE PC5 unicast user plane security protection based on the agreed user plane security policy, as specified in 3GPP TS 33.503 [34].

Editor’s note: The security parameters for 5G ProSe UE-to-UE relay and the parameters for 5G ProSe layer-2 UE-to-UE relay are FFS.

After the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message is generated, the target 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 shall start timer T5090 if:

a) at least one of ProSe identifiers for the 5G ProSe direct links satisfies the privacy requirements as specified in clause 5.2.4; or

b) T5090 is configured as specified in clause 5.2.5.

NOTE 5: Two UEs negotiate the PC5 DRX configuration in the AS layer, and the PC5 DRX parameter values are configured per pair of source and destination Layer-2 IDs in the AS layer, as specified in 3GPP TS 38.300 [21].

After sending the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message, the target UE shall provide the following information along with the layer-2 IDs to the lower layer, which enables the lower layer to handle the coming PC5 signalling or traffic data:

a) the PC5 link identifier self-assigned for this 5G ProSe direct link;

b) PQFI(s) and its corresponding PC5 QoS parameters, if available; and

c) an indication of activation of the PC5 unicast user plane security protection for the 5G ProSe direct link, if applicable.

If the target UE accepts the 5G ProSe direct link establishment request and the 5G ProSe direct link is established not for 5G ProSe direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE and not for 5G ProSe direct communication between the 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE, then the target UE may perform the PC5 QoS flow establishment over 5G ProSe direct link as specified in clause 7.2.7. If the 5G ProSe direct link is established for 5G ProSe direct communication between the 5G ProSe layer-3 remote UE and the 5G ProSe layer-3 UE-to-network relay UE, then the target UE may perform the PC5 QoS flow establishment over 5G ProSe direct link as specified in clause 8.2.6. If the 5G ProSe direct link is established for 5G ProSe direct communication between the 5G ProSe layer-3 end UE and the 5G ProSe layer-3 UE-to-UE relay UE, then the target UE may perform the PC5 QoS flow establishment over 5G ProSe direct link as specified in clause 8a.2.7.

\*\*\*\*\* Next change \*\*\*\*\*

#### 7.2.2.4 5G ProSe direct link establishment procedure completion by the initiating UE

If the Target user info IE is included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message, upon receipt of the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message, the initiating UE shall stop timer T5080. If the Target user info IE is not included in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message the initiating UE may keep the timer T5080 running and continue to handle multiple response messages (i.e., the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message) from multiple target UEs.

For each of the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message received, the initiating UE shall uniquely assign a PC5 link identifier and create a 5G ProSe direct link context for each of the 5G ProSe direct link(s). Then the initiating UE shall store the source layer-2 ID and the destination layer-2 ID used in the transport of this message provided by the lower layers in the 5G ProSe direct link context(s) to complete the establishment of the 5G ProSe direct link with the target UE(s). From this time onward the initiating UE shall use the established link(s) for ProSe direct communication over PC5 and additional PC5 signalling messages to the target UE(s).

If the initiating UE is acting as the 5G ProSe UE-to-UE relay UE and the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe UE-to-UE relay UE and target 5G ProSe end UE with integrated discovery, upon receipt of the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message from the target 5G ProSe end UE, the initiating UE shall initiate the 5G ProSe direct link security mode control procedure with the source 5G ProSe end UE, and upon successful completion of the 5G ProSe direct link security mode control procedure with the source 5G ProSe end UE, create a PROSE DIRECT LINK ESTABLISHMENT ACCEPT message as specified in clause 7.2.2.3 to send to the source 5G ProSe end UE.

After receiving the PROSE DIRECT LINK ESTABLISHMENT ACCEPT message, the initiating UE shall provide the following information along with the layer-2 IDs to the lower layer, which enables the lower layer to handle the coming PC5 signalling or traffic data:

a) the PC5 link identifier self-assigned for this 5G ProSe direct link;

b) PQFI(s) and its corresponding PC5 QoS parameters, if available; and

c) an indication of activation of the PC5 unicast user plane security protection for the 5G ProSe direct link, if applicable.

The initiating UE shall start timer T5090 if:

a) at least one of ProSe identifiers for the 5G ProSe direct links satisfies the privacy requirements as specified in clause 5.2.4; or

b) T5090 is configured as specified in clause 5.2.5.

In addition, the initiating UE may perform the PC5 QoS flow establishment over 5G ProSe direct link as specified in clause 7.2.7.

Upon expiry of the timer T5080, if the PROSE DIRECT LINK ESTABLISHMENT REQUEST message did not include the Target user info IE and the initiating UE received at least one PROSE DIRECT LINK ESTABLISHMENT ACCEPT message, it is up to the UE implementation to consider the 5G ProSe direct link establishment procedure as complete or to restart the timer T5080.

\*\*\*\*\* Next change \*\*\*\*\*

#### 7.2.2.5 5G ProSe direct link establishment procedure not accepted by the target UE

If the PROSE DIRECT LINK ESTABLISHMENT REQUEST message cannot be accepted, the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message. The PROSE DIRECT LINK ESTABLISHMENT REJECT message contains a PC5 signalling protocol cause IE set to one of the following cause values:

#1 direct communication to the target UE not allowed;

#3 conflict of layer-2 ID for unicast communication is detected;

#5 lack of resources for 5G ProSe direct link;

#13 congestion situation;

#15 security procedure failure of 5G ProSe UE-to-network relay;

#xx Failure from 5G ProSe end UE;

#yy 5G ProSe direct link for the pair of user info IDs already exists; or

#111 protocol error, unspecified.

If the target UE is not allowed to accept the PROSE DIRECT LINK ESTABLISHMENT REQUEST message, e.g., based on operator policy or configuration parameters for ProSe direct communication over PC5 as specified in clause 5.2, or the target UE is acting as a layer-3 relay UE, is in non-allowed area of its serving PLMN and the corresponding relay service code is not associated with high priority access as defined in clause 5.3.5 of 3GPP TS 24.501 [11], the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #1 "direct communication to the target UE not allowed".

For a received PROSE DIRECT LINK ESTABLISHMENT REQUEST message from a layer-2 ID (for unicast communication), if the target UE already has an existing link established to a UE using this layer-2 ID or is currently processing a PROSE DIRECT LINK ESTABLISHMENT REQUEST message from the same layer-2 ID and with one of following parameters different from the existing link or the link for which the link establishment is in progress:

a) the source user info;

b) type of data (e.g., IP or non-IP); or

c) security policy,

the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #3 "conflict of layer-2 ID for unicast communication is detected".

NOTE 1: If the UE is processing a PROSE DIRECT DISCOVERY message from the same source layer-2 ID of the received PROSE DIRECT LINK ESTABLISHMENT REQUEST message, it depends on UE implementation to avoid the conflict of destination layer-2 ID (e.g. send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #3 "conflict of layer-2 ID for unicast communication is detected", or ignore the PROSE DIRECT DISCOVERY message).

NOTE 2: The type of data (e.g., IP or non-IP) is indicated by the optional IP address configuration IE included in the corresponding DIRECT LINK SECURITY MODE COMPLETE message, i.e., the type of data for the requested link is IP type if this IE is included and the type of data for the requested link is non-IP if this IE is not included.

If the 5G ProSe direct link establishment fails due to the implementation-specific maximum number of established 5G ProSe direct links has been reached, or other temporary lower layer problems causing resource constraints, the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #5 "lack of resources for 5G ProSe direct link".

If the 5G ProSe direct link establishment request is for relaying and:

a) the NAS level mobility management congestion control as specified in clause 5.3.9 of TS 24.501 [11] is activated at the target UE; or

b) the target UE is under congestion;

the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #13 "congestion situation". The target UE may provide a back-off timer value to the initiating UE in the PROSE DIRECT LINK ESTABLISHMENT REJECT message. The target UE shall not accept any 5G ProSe direct link establishment request for relaying if the back-off timer for NAS level mobility management congestion control is running.

If the 5G ProSe direct link establishment request is for relaying, the NAS level session management congestion as specified in clause 6.2.7 and in clause 6.2.8 of TS 24.501 [11] is activated at the target UE which is acting as a 5G ProSe layer-3 UE-to-network relay UE, and the relay service code used in the 5G ProSe direct link establishment corresponds to a DNN and/or S-NSSAI for which the NAS level session management congestion is activated, and the target UE needs to perform the PDU session establishment procedure for the DNN and/or S-NSSAI or the PDU session modification procedure for the DNN and/or S-NSSAI, then the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #13 "congestion situation". The target UE may provide a back-off timer value to the initiating UE in the PROSE DIRECT LINK ESTABLISHMENT REJECT message.

NOTE 3: How the target UE determines that it is under congestion is implementation specific (e.g., any relaying related operational overhead, etc).

NOTE 4: In case the target UE is under the NAS level mobility management congestion control, it is an implementation option that the provided back-off timer value to the initiating UE is set to the remaining time of the mobility management back-off timer T3346 or with an additional offset value.

If the 5G ProSe direct link establishment request is for relaying, the request required the establishment of a PDU session by the 5G ProSe layer-3 UE-to-network relay UE which is a target UE, and the PDU session establishment was unsuccessful due to the reception of 5GSM cause #8 "maximum number of PDU sessions reached", #27 "Missing or unknown DNN", #28 "Unknown PDU session type", #29 "user authentication or authorization failed", #31 "request rejected, unspecified", #32 "service option not supported", #33 "requested service option not subscribed", or #65 "maximum number of PDU sessions reached" as specified in 3GPP TS 24.501 [11], then target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #111 "protocol error, unspecified".

If the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe remote UE and the 5G ProSe UE-to-network relay UE and it fails due to a failure in the security procedure over control plane or security procedure over user plane as specified in 3GPP TS 33.503 [34], the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #15 "security procedure failure of 5G ProSe UE-to-network relay". The target UE shall provide the EAP message if received from the network according to the security procedure over control plane as specified in 3GPP TS 33.503 [34].

If the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe UE-to-UE relay UE and target 5G ProSe end UE with integrated discovery, and the target user info ID is not specified, if direct link establishment procedure fails due to an already existing 5G ProSe direct link for the pair of initiating UE user info ID and target UE user info ID, the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #yy "5G ProSe direct link for the pair of user info IDs already exists".

If the target UE is acting as a target 5G ProSe end UE and the 5G ProSe direct link establishment procedure is between the 5G ProSe UE-to-UE relay UE and the target 5G ProSe end UE, the target 5G ProSe end UE may include in the PROSE DIRECT LINK ESTABLISHMENT REJECT message:

a) the source end UE info IE set to the user info ID of the source 5G ProSe end UE;

b) the target end UE info IE set to the user info ID of the target 5G ProSe end UE; and

c) the UE-to-UE relay UE info IE set to the user info ID of the 5G ProSe UE-to-UE relay UE.

If the target UE is acting as a 5G ProSe UE-to-UE relay UE, the 5G ProSe direct link establishment procedure is between the source 5G ProSe end UE and the 5G ProSe UE-to-UE relay UE, and the target 5G ProSe end UE has rejected the 5G ProSe direct link establishment procedure or the 5G ProSe direct link modification procedure, then the 5G ProSe UE-to-UE relay UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message with PC5 signalling protocol cause value #xx "Failure from 5G ProSe end UE" to the source 5G ProSe end UE. The 5G ProSe UE-to-UE relay UE may include in the PROSE DIRECT LINK ESTABLISHMENT REJECT message the PC5 end UE failure cause IE set to the PC5 signalling protocol cause received from the target 5G ProSe end UE that has rejected the 5G ProSe direct link establishment procedure. The 5G ProSe UE-to-UE relay UE may include in the PROSE DIRECT LINK MODIFICATION REJECT message:

a) the source end UE info IE set to the user info ID of the source 5G ProSe end UE;

b) the target end UE info IE set to the user info ID of the target 5G ProSe end UE; and

c) the UE-to-UE relay UE info IE set to the user info ID of the 5G ProSe UE-to-UE relay UE.

NOTE 5: The cause value #15 "security procedure failure of 5G ProSe UE-to-network relay" is also used when the CP-PRUK or the UP-PRUK is not found in the network.

If the 5G ProSe direct link establishment fails due to other reasons, the target UE shall send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #111 "protocol error, unspecified".

After sending the PROSE DIRECT LINK ESTABLISHMENT REJECT message, the target UE shall provide the following information along with the initiating UE's layer-2 ID for unicast communication and the target UE's layer-2 ID for unicast communication to the lower layer:

a) an indication of deactivation of the PC5 unicast security protection and deletion of security context for the 5G ProSe direct link, if applicable.

Upon receipt of the PROSE DIRECT LINK ESTABLISHMENT REJECT message, the initiating UE shall stop timer T5080 and abort the 5G ProSe direct link establishment procedure. If the PC5 signalling protocol cause value in the PROSE DIRECT LINK ESTABLISHMENT REJECT message is #1 "direct communication to the target UE not allowed" or #5 "lack of resources for 5G ProSe direct link", then the initiating UE shall not attempt to start the 5G ProSe direct link establishment procedure with the same target UE at least for a time period T. If the PC5 signalling protocol cause value in the PROSE DIRECT LINK ESTABLISHMENT REJECT message is #13 "congestion situation" and a back-off timer value is provided in the PROSE DIRECT LINK ESTABLISHMENT REJECT message, the initiating UE shall start timer T5088 associated with the layer-2 ID of the target UE and set its value to the provided timer value. If the PC5 signalling protocol cause value in the PROSE DIRECT LINK ESTABLISHMENT REJECT message is #15 "security procedure failure of 5G ProSe UE-to-network relay", and initiating UE has included the UE identity IE set to SUCI in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message, then the initiating UE shall initiate the UE-to-network relay reselection procedure as specified in clause 8.2.3. If the PC5 signalling protocol cause value in the PROSE DIRECT LINK ESTABLISHMENT REJECT message is #15 "security procedure failure of 5G ProSe UE-to-network relay" and the initiating UE has included the User security key ID IE set to UP-PRUK ID or CP-PRUK ID in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message, then the initiating UE may initiate the UE-to-network relay reselection procedure as specified in clause 8.2.3 and the UE shall further:

a) if the same 5G ProSe UE-to-network relay UE is selected, discard the previously used CP-PRUK and associated CP-PRUK ID, or the UP-PRUK and associated UP-PRUK ID, if any, and include the UE identity IE set to SUCI in the PROSE DIRECT LINK ESTABLISHMENT REQUEST when initiating the subsequent 5G ProSe direct link establishment procedure as specified in clause 7.2.2.2; or

b) if a different 5G ProSe UE-to-network relay UE is selected, include the User security key ID IE set to the previously used UP-PRUK ID or CP-PRUK ID in the PROSE DIRECT LINK ESTABLISHMENT REQUEST message.

NOTE 5: The length of time period T is UE implementation specific and can be different for the case when the UE receives PC5 signalling protocol cause value #1 "direct communication to the target UE not allowed" or when the UE receives PC5 signalling protocol cause value #5 "lack of resources for 5G ProSe direct link".

If the 5G ProSe direct link establishment procedure is for direct communication between the 5G ProSe UE-to-UE relay UE and target 5G ProSe end UE and if the PC5 signalling protocol cause value in the PROSE DIRECT LINK ESTABLISHMENT REJECT message is #yy "5G ProSe direct link for the pair of peer application layer IDs already exists", then the initiating UE acting as the 5G ProSe UE-to-UE relay shall initiate the 5G ProSe direct link modification procedure with the target UE to associate the source End UE user info ID and the ProSe identifiers, as specified on the rejected 5G ProSe direct link establishment request, to the existing 5G ProSe direct link.

After receiving the PROSE DIRECT LINK ESTABLISHMENT REJECT message, the initiating UE shall provide the following information along with the initiating UE's layer-2 ID for unicast communication and the target UE's layer-2 ID for unicast communication to the lower layer:

a) an indication of deactivation of the PC5 unicast security protection and deletion of security context for the 5G ProSe direct link, if applicable.

\*\*\*\*\* Next change \*\*\*\*\*

### 11.3.8 PC5 signalling protocol cause

The purpose of the PC5 signalling protocol cause information element is to indicate the cause used in the PC5 signalling protocol procedures.

The PC5 signalling protocol cause is a type 3 information element with a length of 2 octets.

The PC5 signalling protocol cause information element is coded as shown in figure 11.3.8.1 and table 11.3.8.1.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
| PC5 signalling protocol cause IEI | octet 1 |
| PC5 signalling cause value | octet 2 |

Figure 11.3.8.1: PC5 signalling protocol cause information element

Table 11.3.8.1: PC5 signalling protocol cause information element

|  |
| --- |
| PC5 signalling cause value (octet 2) |
|  |
| Bits |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |  |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  | Direct communication to the target UE not allowed |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |  | Direct communication to the target UE no longer needed |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |  | Conflict of layer-2 ID for unicast communication is detected |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |  | Direct connection is not available anymore |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |  | Lack of resources for 5G ProSe direct link |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |  | Authentication failure |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |  | Integrity failure |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |  | UE security capabilities mismatch |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |  | LSB of KNRP-sess ID conflict |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |  | UE PC5 unicast signalling security policy mismatch |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |  | Required service not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |  | Security policy not aligned |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |  | Congestion situation |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |  | Authentication synchronisation error |
| 000 | 000 | 000 | 011 | 100 | 101 | 110 | 100 |  | Security procedure failure of 5G ProSe UE-to-network relaypath switching is not allowed for the ProSe applicationscommunication path over Uu is not available for path switching |
| x | x | x | x | x | x | x | x |  | Failure from 5G ProSe end UE |
| y | y | y | y | y | y | y | y |  | 5G ProSe direct link for the pair of peer UEs application layer IDs already exists |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |  | Protocol error, unspecified |
| Any other value received by the UE shall be treated as 0110 1111, "protocol error, unspecified". |

\*\*\*\*\* End of change \*\*\*\*\*