**3GPP TSG-CT WG1 Meeting #135-eC1-222639**

**E-Meeting, 6th – 12th April 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **554** | **CR** |  | **rev** | **-** | **Current version:** | **.0.0** |  |
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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 | **X** |

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|  |
| ***Title:***  | Update to Mobility Restrictions for 5G ProSe UE-to-Network Relaying  |
|  |  |
| ***Source to WG:*** | CATT |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | 5G\_ProSe |  | ***Date:*** | 2022-03-28 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | Mobility Restrictions for 5G ProSe UE-to-Network Relaying need to be updated to align with the latest Stage 2 specification in clause 5.4.3 of TS 23.304 v17.2.0. |
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| ***Summary of change:*** | 1. Update the description of 5G ProSe UE-to-network relay UE and remote UE behaviours in non-allowed service area;
2. Add description of 5G ProSe UE-to-network relay UE and remote UE behaviours in forbidden tracking areas.
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| ***Consequences if not approved:*** | Incorrect/Unclear 5G ProSe enabled UE behaviours in non-allowed service area and in forbidden tracking areas. |
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| ***Clauses affected:*** | 7.2.2.5, 8.2.1.1, 8.2.1.2.2.2, 8.2.1.3.2.2 |
|  |  |
|  | **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 ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* First 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; 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: 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.

NOTE 2: How the target UE determines that it is under congestion is implementation specific (e.g., any relaying related operational overhead, etc).

NOTE 3: 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 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.

NOTE 4: 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".

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 \* \* \* \*

#### 8.2.1.1 General

This clause describes the procedures for both layer-3 and layer-2 UE-to-network relay discovery for public safety use and commercial services at a ProSe-enabled UE over the PC5 interface. The purpose of the UE-to-network relay discovery procedure over PC5 interface is to enable a ProSe-enabled UE to detect and identify another ProSe-enabled UE over PC5 interface for UE-to-network relay communication between a UE and 5GC.

NOTE 1: Relaying Multicast/Broadcast Service traffic to a 5G ProSe remote UE by a 5G ProSe UE-to-network relay is not supported in this release of the specification.

A UE-to-network relay supporting multiple relay service codes can advertise the relay service codes using multiple discovery messages, with one relay service code per discovery message.

The following principles for 5G ProSe UE-to-network relay apply when the relay UE or the remote UE is in service area restriction as defined in clause 5.3.5 of 3GPP TS 24.501 [11]:

a) in non-allowed area of its serving PLMN, the 5G ProSe layer-3 UE-to-network relay UE is not allowed to perform relay operations (e.g., UE-to-network relay discovery as specified in clause 8.2.1, or accept the 5G ProSe direct link establishment procedure as specified in clause 7.2.2) except for e.g., high priority access as defined in clause 5.3.5 of 3GPP TS 24.501 [11] based on relay service codes as specified in clause 5.2.5;

b) service area restriction is not applicable to the 5G ProSe layer-3 remote UE;

c) in non-allowed area of its serving PLMN, the 5G ProSe layer-2 UE-to-network relay UE is not allowed to perform relay operations (e.g., UE-to-network relay discovery as specified in clause 8.2.1, or accept the 5G ProSe direct link establishment procedure as specified in clause 7.2.2); and

d) in non-allowed area of its serving PLMN, the 5G ProSe layer-2 remote UE follows the same principles of service area restrictions as specified in clause 5.3.5 of 3GPP TS 24.501 [11] for communication with the network via the 5G ProSe layer-2 UE-to-network relay UE, taking into account the TAI in the RRC container received from the 5G ProSe layer-2 UE-to-network relay UE.

NOTE 2: Closed access group information is not specified for 5G ProSe.

NOTE 3: Principles of operation for emergency services (incl. exceptions from mobility restrictions) are not specified in this release of the specification.

The following principles for 5G ProSe UE-to-network relay apply when the relay UE or the remote UE is in 5GS forbidden tracking areas as defined in clause 5.3.13 of 3GPP TS 24.501 [11]:

a) in a 5GS forbidden tracking area of its serving PLMN, the 5G ProSe UE-to-network relay UE is not allowed to perform relay operations; and

b) in a 5GS forbidden tracking area of its serving PLMN, the 5G ProSe remote UE is not allowed to access the network via the 5G ProSe UE-to-network relay UE, taking into account the TAI in the RRC container received from the 5G ProSe layer-2 UE-to-network relay UE.

To perform UE-to-network relay discovery over PC5 interface, the UE is configured with the related information as described in clause 5.2.5. The following models for UE-to-network relay discovery procedure over PC5 interface as specified in 3GPP TS 23.304 [2] are supported:

a) Model A uses a single discovery protocol message (Announcement); and

b) Model B uses two discovery protocol messages (Solicitation and Response).

NOTE 4: If the UE is authorized to perform both 5G ProSe UE-to-network relay discovery Model A and 5G ProSe UE-to-network relay discovery Model B, it is up to UE implementation to select which model to perform or perform both models simultaneously.

The following procedures are defined for UE-to-network relay discovery procedure over PC5 interface:

a) UE-to-network relay discovery over PC5 interface with Model A:

1) Announcing UE procedure for UE-to-network relay discovery initiation;

2) Announcing UE procedure for UE-to-network relay discovery completion;

3) Monitoring UE procedure for UE-to-network relay discovery initiation;

4) Monitoring UE procedure for UE-to-network relay discovery completion;

5) Announcing UE procedure for UE-to-network relay discovery additional information; and

6) Monitoring UE procedure for UE-to-network relay discovery additional information; and

b) UE-to-network relay discovery over PC5 interface with Model B:

1) Discoverer UE procedure for UE-to-network relay discovery initiation;

2) Discoverer UE procedure for UE-to-network relay discovery completion;

3) Discoveree UE procedure for UE-to-network relay discovery initiation; and

4) Discoveree UE procedure for UE-to-network relay discovery completion.

\* \* \* Next Change \* \* \* \*

###### 8.2.1.2.2.2 Announcing UE procedure for UE-to-network relay discovery initiation

The UE is authorised to perform the announcing UE procedure for UE-to-network relay discovery if:

a) the UE is authorised to act as a UE-to-network relay in the PLMN indicated by the serving cell as specified in clause 5.2.5, and

1) the UE is served by NG-RAN and the UE is authorised to perform 5G ProSe direct discovery in the PLMN as specified in clause 5; or

2) the UE is authorised to perform 5G ProSe direct discovery when not served by NG-RAN as specified in clause 5 and intends to use the provisioned radio resources for UE-to-network relay discovery;

b) the UE is configured with:

1) the relay service code parameter identifying the connectivity service to be announced as specified in clause 5.2.5, and for 5G ProSe layer-3 UE-to-network relay UE,

i) the S-NSSAI associated with that relay service code shall belong to the allowed NSSAI of the UE; and

ii) if the UE is camped on a cell whose TAI is in the list of "non-allowed tracking areas" or is camped on a cell whose TAI is not in the list of "allowed tracking areas", then the relay service code shall be associated with high priority access as defined in clause 5.3.5 of 3GPP TS 24.501 [11]; and

2) the User info ID for the UE-to-network relay discovery parameter as specified in clause 5.2.5;

c) for 5G ProSe layer-3 UE-to-network relay UE, the UE is configured with PDU Session parameters which is used for relayed traffic for the associated relay service code, as specified in clause 5.2.5; and

d) the back-off timer T3346 used for NAS mobility management congestion control as specified in clause 5.3.9 of 3GPP TS 24.501 [11] is not running at the UE;

otherwise, the UE is not authorised to perform the announcing UE procedure for UE-to-network relay discovery.

Figure 8.2.1.2.2.2.1 illustrates the interaction of the UEs in the announcing UE procedure for UE-to-network relay discovery.



Figure 8.2.1.2.2.2.1: Announcing UE procedure for UE-to-network relay discovery

When the UE is triggered by an upper layer application to announce availability of a connectivity service provided by a UE-to-network relay, if the UE is authorised to perform the announcing UE procedure for UE-to-network relay discovery, then the UE:

a) if the UE is served by NG-RAN, and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages for relay discovery as specified in 3GPP TS 38.331 [13], shall perform a service request procedure or mobility registration procedure as specified in 3GPP TS 24.501 [11];

b) shall obtain a valid UTC time for the discovery transmission from the lower layers and generate the UTC-based counter corresponding to this UTC time as specified in clause 11.2.5;

c) shall generate a PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement according to clause 10.2.1. In the PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement, the UE:

1) shall set the announcer info parameter to the User info ID for the UE-to-network relay discovery parameter, as specified in clause 5.2.5;

2) shall set the relay service code parameter to the relay service code parameter identifying the connectivity service to be announced, as specified in clause 5.2.5;

3) shall set the UTC-based counter LSB parameter to include the eight least significant bits of the UTC-based counter;

4) shall set the Resource Status Indicator bit of the status indicator parameter to indicate whether or not the UE has resources available to provide a connectivity service for additional ProSe-enabled UEs;

5) shall set the ProSe direct discovery PC5 message type parameter as specified in table 10.2.1.8; and

6) if acting as 5G ProSe layer-2 UE-to-network relay UE, shall set the NCGI parameter to the NCGI of its serving cell;

d) shall apply the DUIK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.503 [34];

e) shall set the destination layer-2 ID to the default destination layer-2 ID as specified in clause 5.2.5, and self-assign a source layer-2 ID for sending the UE-to-network relay discovery announcement; and

f) shall pass the resulting PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement to the lower layers for transmission over the PC5 interface with the source layer-2 ID, destination layer-2 ID, and an indication that the message is for 5G ProSe direct discovery.

The UE shall ensure that it keeps on passing the same PROSE PC5 DISCOVERY message along with the same source layer-2 ID, destination layer-2 ID, and an indication that the message is for 5G ProSe direct discovery to the lower layers for transmission until the UE is triggered by an upper layer application to stop announcing availability of a connectivity service provided by a UE-to-network relay, or until the UE stops being authorised to perform the announcing UE procedure for UE-to-network relay discovery. How this is achieved is left up to UE implementation.

Editor's note: Details of security aspects of a PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement are FFS and will be determinated by cooperation with SA WG2 and SA WG3.

\* \* \* Next Change \* \* \* \*

###### 8.2.1.3.2.2 Discoveree UE procedure for UE-to-network relay discovery initiation

The UE is authorised to perform the discoveree UE procedure for UE-to-network relay discovery if:

a) the UE is authorised to act as a UE-to-network relay UE in the PLMN indicated by the serving cell, and

1) the UE is served by NG-RAN; or

2) the UE is not served by NG-RAN, and intends to use the provisioned radio resources for UE-to-network relay discovery;

b) the UE is configured with:

1) the relay service code parameter identifying the connectivity service to be responded to as specified in clause 5.2.5, and for 5G ProSe layer-3 UE-to-network relay UE,

i) the S-NSSAI associated with that relay service code shall belong to the allowed NSSAI of the UE; and

ii) if the UE is camped on a cell whose TAI is in the list of "non-allowed tracking areas" or is camped on a cell whose TAI is not in the list of "allowed tracking areas", then the relay service code shall be associated with high priority access as defined in clause 5.3.5 of 3GPP TS 24.501 [11]; and

2) the User info ID for the UE-to-network relay discovery parameter, as specified in clause 5.2.5; and

c) the back-off timer T3346 used for NAS mobility management congestion control as specified in clause 5.3.9 of 3GPP TS 24.501 [11] is not running at the UE;

otherwise, the UE is not authorised to perform the discoveree UE procedure for UE-to-network relay discovery.

Figure 8.2.1.3.2.2.1 illustrates the interaction of the UEs in the discoveree UE procedure for UE-to-network relay discovery.



Figure 8.2.1.3.2.2.1: Discoveree UE procedure for UE-to-network Relay discovery

When the UE is triggered by an upper layer application to start responding to solicitation on proximity of a connectivity service provided by the UE-to-network Relay, and if the UE is authorised to perform the discoveree UE procedure for UE-to-network Relay discovery, then the UE:

a) if the UE is served by NG-RAN, and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [13], shall perform a service request procedure as specified in 3GPP TS 24.501 [11]; and

b) shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY messages.

Upon reception of a PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation, for the relay service code of the connectivity service which the UE is authorized to respond, the UE shall use the associated DUSK, if configured, and the UTC-based counter obtained during the reception operation to unscramble the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.503 [34]. Then, if a DUCK is configured, the UE shall use the DUCK and the UTC-based counter to decrypt the configured message-specific confidentiality-protected portion, as described in 3GPP TS 33.503 [34]. Finally, if a DUIK is configured, the UE shall use the DUIK and the UTC-based counter to verify the MIC field in the unscrambled PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation.

Editor's note: Details of Discoverer UE procedure upon reception of a PROSE PC5 DISCOVERY message for direct discovery response are FFS and will be determinated by cooperation with SA WG3.

NOTE: The UE can determine the received PROSE PC5 DISCOVERY message for 5G ProSe direct discovery announcement is for 5G ProSe direct discovery based on an indication from the lower layer.

Then, if the relay service code parameter of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation is the same as the relay service code parameter configured as specified in clause 5.2.5 for the connectivity service,

then the UE:

a) shall obtain a valid UTC time for the discovery transmission from the lower layers and generate the UTC-based counter corresponding to this UTC time;

b) shall generate a PROSE PC5 DISCOVERY message for UE-to-network relay discovery response. In the PROSE PC5 DISCOVERY message for UE-to-network relay discovery response, the UE:

1) shall set the Discoveree info parameter to the User info ID for the UE-to-network Relay discovery parameter, configured in clause 5.2.5;

2) shall set the relay service code parameter to the relay service code parameter of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation;

3) shall set the UTC-based counter LSB parameter to include the eight least significant bits of the UTC-based counter;

4) shall set the ProSe direct discovery PC5 message type parameter as specified in table 10.2.1.10; and

5) if acting as 5G ProSe layer-2 UE-to-network relay UE, shall set the NCGI parameter to the NCGI of its serving cell;

c) shall apply the DUIK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.503 [34];

Editor's note: Details of security related content in c) are FFS and will be determinated by SA3.

d) shall set the destination layer-2 ID to the source layer-2 ID from the discoverer UE used in the transportation of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation, and self-assign a source layer-2 ID for sending the UE-to-network relay discovery response message; and

e) shall pass the resulting PROSE PC5 DISCOVERY message for UE-to-network relay discovery response along with the source layer-2 ID, destination layer-2 ID, and an indication that the message is for 5G ProSe direct discovery to the lower layers for transmission over the PC5 interface.

\* \* \* End of Changes \* \* \* \*