**3GPP TSG CT WG1 Meeting #138-eC1-22xxxx**

**E-Meeting, 10th – 14th October 2022 (was C1-225708)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **24.554** | **CR** | **0178** | **rev** | **2** | **Current version:** | **17.2.1** |  |
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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:***  | Correction on ProSe U2N Relay discovery initiation  |
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| ***Source to WG:*** | ASUSTeK |
| ***Source to TSG:*** | C1 |
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| ***Work item code:*** | 5G\_ProSe |  | ***Date:*** | 2022-09-30 |
|  |  |  |  |  |
| ***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:*** | According to TS38.300-h10, L2 U2N relay UE should forward paging message to its connected L2 U2N remote UE in RRC\_IDLE/INACTIVE.16.12.5.6 PagingWhen both L2 U2N Relay UE and L2 U2N Remote UE are in RRC IDLE or RRC INACTIVE, the L2 U2N Relay UE monitors paging occasions of its connected L2 U2N Remote UE(s). When a L2 U2N Relay UE needs to monitor paging for a L2 U2N Remote UE, the L2 U2N Relay UE should monitor all POs of the L2 U2N Remote UE.The L2 U2N remote UE in RRC\_IDLE/INACTIVE implies no connectivity service is currently initiated in this L2 U2N remote UE. Before establishing a PC5 connection with a 5G ProSe layer-2 relay UE, a 5G ProSe layer-2 remote UE needs to perform relay discovery to find the 5G ProSe layer-2 relay UE. But, according to the current procedural text in sub-clause 8.2.1.2.3.2, relay discovery mode A may be initiated when the UE is triggered by application for monitoring proximity of a connectivity service. In other words, the relay discovery mode A procedure may be triggered due to initiation of a connectivity service. It is also similar to the case of relay discovery mode B.When the UE is triggered by an upper layer application to monitor proximity of a connectivity service provided by a UE-to-network relay or when the UE has established a direct link with a 5G ProSe UE-to-network relay UE as specified in clause 7.2 and if the UE is authorised to perform the monitoring UE procedure for UE-to-network relay discovery, then the UE shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY messages with the default destination layer-2 ID as specified in clause 5.2.5.According to the above procedural text, a 5G ProSe layer-2 remote UE would not perform relay discovery before any connectivity service is initiated when the 5G ProSe layer-2 remote UE is in RRC\_IDLE/INACTIVE. In this situation, the 5G ProSe layer-2 remote UE would not find and connect with a 5G ProSe layer-2 relay UE. As a result, the network may not be able to reach the 5G ProSe layer-2 remote UE via 5G ProSe layer-2 relay UE by paging. |
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| ***Summary of change:*** | 1. In sub-clause 8.2.1.2.3.1, the purpose of the monitoring UE procedure for UE-to-network relay discovery is clarified.
2. In sub-clause 8.2.1.2.3.2, the condition for 5G ProSe layer-2 remote UE to monitor discovery messages is modified. Besides, the statement about UE considering a found 5G ProSe UE-to-network relay UE are modified.
3. In sub-clause 8.2.1.3.1.1, the purpose of the discoverer UE procedure for UE-to-network Relay discovery is clarified.
4. In sub-clause 8.2.1.3.1.2, the condition for 5G ProSe layer-2 remote UE to send discovery solicitation messages is modified. Besides, the statement about UE considering a found 5G ProSe UE-to-network relay UE is modified.

Backward compatibility analysis:The changes clarify the related UE behavior in the specification and will not affect the related operation in legacy UEs. Thus, this CR is backward compatible. |
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| ***Consequences if not approved:*** | The network may not be able to reach a 5G ProSe layer-2 remote UE by paging before any connectivity service is initiated when the 5G ProSe layer-2 remote UE is in RRC\_IDLE/INACTIVE. |
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| ***Clauses affected:*** | 8.2.1.2.3.1, 8.2.1.2.3.2, 8.2.1.3.1.1, 8.2.1.3.1.2 |
|  |  |
|  | **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:*** |  |

\* \* \* Start of 1st Change \* \* \* \*

8.2.1.2.3.1 General

The purpose of the monitoring UE procedure for UE-to-network relay discovery is:

a) to enable a ProSe-enabled UE to become aware of proximity of a connectivity service provided by a UE-to-network relay, upon a request from upper layers as defined in 3GPP TS 23.304 [2];

b) to enable a ProSe-enabled UE to become aware of proximity of a 5G ProSe layer-2 UE-to-network relay UE, upon a request from upper layers; or

c) to enable a ProSe-enabled UE to perform measurements of signal strength of PROSE PC5 DISCOVERY messages from 5G ProSe UE-to-network relay UE(s) for relay selection/reselection.

\* \* \* Start of 2nd Change \* \* \* \*

8.2.1.2.3.2 Monitoring UE procedure for UE-to-network relay discovery initiation

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

a) the following is true:

1) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery using monitoring when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;

2) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery monitoring in at least one PLMN; or

3) the UE is:

i) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [14] and the reason for the UE being in limited service state is one of the following:

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

B) 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

C) 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]; and

ii) authorised to perform 5G ProSe direct discovery using monitoring when the UE is not served by NG-RAN; and:

A) configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;

b) the UE is configured with the relay service code parameter identifying the connectivity service to be monitored, as specified in clause 5.2.5; and

c) for 5G ProSe layer-2 remote UE, the UE is camped on a cell whose TAI is not in the list of "non-allowed tracking areas" or is camped on a cell whose TAI is in the list of "allowed tracking areas",

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

Figure 8.2.1.2.3.2.1 illustrates the interaction of the UEs in the monitoring UE procedure for UE-to-network relay discovery.

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**Figure 8.2.1.2.3.2.1: Monitoring UE procedure for UE-to-network relay discovery**

When the UE is triggered by an upper layer application to monitor proximity of a connectivity service provided by a UE-to-network relay, when the UE desires to use a 5G ProSe layer-2 UE-to-network relay UE or when the UE has established a direct link with a 5G ProSe UE-to-network relay UE as specified in clause 7.2, and if the UE is authorised to perform the monitoring UE procedure for UE-to-network relay discovery, then the UE shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY messages with the default destination layer-2 ID as specified in clause 5.2.5.

If the traffic descriptor is configured as specified in clause 5.2.5, the 5G ProSe layer-3 remote UE shall determine the monitored RSC by mapping the traffic from the upper layer application with the traffic descriptor as follows:

a) if there are at least one ProSe application traffic descriptor(s) to be used for the relayed traffic as specified in clause 5.2.5 which has not yet been evaluated,

1) if the ProSe application traffic descriptor matches upper layer application information;

 the UE shall select the RSC associated with the matched ProSe application traffic descriptor for monitoring. If more than one RSCs are associated with the upper layer application information, it is up to UE implementation to select a RSC in this release of specification;

2) else, the UE shall select the next ProSe application traffic descriptor which has not yet been evaluated and proceed to step 1);

b) else, it is up to UE implementation to select a RSC.

NOTE 1: Selection of relay service code is up to UE implementation if there is no ProSe application traffic descriptor(s) configured in the UE.

Upon reception of a PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement according to clause 10.2.1, for the target relay service code of the connectivity service which the UE is authorized to monitor, the UE shall use the associated DUSK, if received from the 5G DDNMF or 5G PKMF (if security procedure over user plane for 5G ProSe UE-to-network relay is used) and the UTC-based counter obtained during the monitoring operation to unscramble the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.503 [34]. Then, if a DUCK is received from the 5G DDNMF or 5G PKMF (if security procedure over user plane for 5G ProSe UE-to-network relay is used), 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 received from the 5G DDNMF or 5G PKMF (if security procedure over user plane for 5G ProSe UE-to-network relay is used), 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 announcement.

NOTE 2: The use of an erroneous UTC-based counter for processing received PROSE PC5 DISCOVERY messages at the ProSe-enabled UE can cause MIC check failure after DUIK is used for integrity check and malformed contents after DUSK is used for unscrambling or DUCK is used for deciphering. How a ProSe-enabled UE ensures the accuracy of the UTC-based counter is left to UE implementation.

NOTE 3: The UE can determine the received PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement is for 5G ProSe direct discovery based on an indication from the lower layer.

Then if:

a) the relay service code parameter of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement is the same as the relay service code parameter configured as specified in clause 5 for the connectivity service being monitored; and

b) the User info ID of the UE-to-network relay is not configured as specified in clause 5 for the connectivity service being monitored, or the announcer info parameter of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement is the same as the User info ID of the UE-to-network relay configured as specified in clause 5.2.5 for the connectivity service being monitored,

then the UE shall consider that the connectivity service or the 5G ProSe layer-2 UE-to-network relay UE the UE seeks to monitor has been discovered. In addition, the UE can measure the signal strength of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery announcement for relay selection or reselection.

\* \* \* Start of 3rd Change \* \* \* \*

8.2.1.3.1.1 General

The purpose of the discoverer UE procedure for UE-to-network Relay discovery is:

a) to enable a ProSe-enabled UE to solicit proximity of a connectivity service provided by a UE-to-network Relay, upon a request from upper layers;

b) to enable a ProSe-enabled UE to solicit proximity of a 5G ProSe layer-2 UE-to-network relay UE, upon a request from upper layers; or

c) to enable a ProSe-enabled UE to measure the PROSE PC5 DISCOVERY message signal strength between the ProSe-enabled UE and the 5G ProSe UE-to-network Relay UE(s) for relay selection/reselection.

In this procedure, the UE sending the PROSE PC5 DISCOVERY message is called the "discoverer UE" and the other UE is called the "discoveree UE".

\* \* \* Start of 4th Change \* \* \* \*

8.2.1.3.1.2 Discoverer UE procedure for UE-to-network relay discovery initiation

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

a) one of the following is true:

1) the UE is not served by NG-RAN, is authorised to act as a 5G ProSe remote UE towards a 5G ProSe UE-to-network relay UE and is configured with the radio parameters to be used for ProSe UE-to-network relay discovery when not served by NG-RAN;

2) the UE is served by NG-RAN, is authorised to act as a 5G ProSe remote UE towards a 5G ProSe UE-to-network relay UE; or

3) the UE is:

i) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [14] and the reason for the UE being in limited service state is one of the following:

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

B) 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

C) 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]; and

ii) authorised to act as a 5G ProSe remote UE towards a 5G ProSe UE-to-network relay UE when the UE is not served by NG-RAN and configured with the radio parameters to be used for ProSe UE-to-network relay discovery use when not served by NG-RAN;

b) the UE is configured with the relay service code parameter identifying the connectivity service to be solicited and with the User info ID for the UE-to-network relay discovery parameter, as specified in clause 5.2.5; and

c) for 5G ProSe layer-2 remote UE, the UE is camped on a cell whose TAI is not in the list of "non-allowed tracking areas" or is camped on a cell whose TAI is in the list of "allowed tracking areas",

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

Figure 8.2.1.3.1.2.1 illustrates the interaction of the UEs in the discoverer UE procedure for UE-to-network relay discovery.

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**Figure 8.2.1.3.1.2.1: Discoverer UE procedure for UE-to-network Relay discovery**

For PROSE PC5 DISCOVERY message signal strength measurement, the UE manages a periodic measurement timer T5109, which is used to trigger the periodic PROSE PC5 DISCOVERY message signal strength measurement between the UE and the ProSe UE-to-network relay UE with which the UE has a link established. It is started whenever the UE has established a direct link with a 5G ProSe UE-to-network relay UE and restarted whenever the UE receives the PROSE PC5 DISCOVERY message for UE-to-network relay discovery response from the 5G ProSe UE-to-network relay UE with which the UE has a link established.

When the UE is triggered by an upper layer application to solicit proximity of a connectivity service provided by a 5G ProSe UE-to-network relay UE, when the UE desires to use a 5G ProSe layer-2 UE-to-network relay UE or when the periodic measurement timer T5109 expires, and if the UE is authorised to perform the discoverer 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 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;

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

1) shall set the discoverer 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 identifying the connectivity service to be solicited, configured in clause 5.2.5. For the 5G ProSe layer-3 remote UE, if the traffic descriptor is configured as specified in clause 5.2.5, the UE shall determine the RSC as follows:

i) if there are at least one ProSe application traffic descriptor(s) to be used for the relayed traffic as specified in clause 5.2.5 which has not yet been evaluated,

A) if the ProSe application traffic descriptor matches the upper layer application information;

 the UE shall select the RSC associated with the matched ProSe application traffic descriptor for solicitation. If more than one RSCs are associated with the upper layer application information, it is up to UE implementation to select a RSC in this release of specification;

B) else, the UE shall select the next ProSe application traffic descriptor which has not yet been evaluated and proceed to step A);

ii) else, it is up to UE implementation to select a RSC.

NOTE 1: Selection of relay service code is up to UE implementation if there is no ProSe application traffic descriptor(s) configured in the UE.

3) shall include the MIC filed computed as described in 3GPP TS 33.503 [34] by using the UTC-based counter and the DUIK contained in the <UNR-discovery-security-parameters-accept> element of the PROSE\_SECURITY\_PARAM\_RESPONSE message;

4) shall set the UTC-based counter LSB parameter to the 4 least significant bits of the UTC-based counter;

5) shall set the ProSe direct discovery PC5 message type parameter as specified in table 10.2.1.9; and

6) may include the target discoveree info parameter set to the user info ID of the targeted discoveree user if the target discoveree info is provided by the application layer;

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 default destination layer-2 ID as specified in clause 5.2.5 to the destination layer-2 ID and self-assign a source layer-2 ID for sending the UE-to-network relay discovery solicitation message; and

NOTE 2: The UE implementation ensures that the value of the self-assigned source layer-2 ID is different from any other self-assigned source layer-2 ID(s) in use for 5G ProSe direct communication as specified in clause 7.2, is different from any other provisioned destination layer-2 ID(s) as specified in clause 5.2 and is different from any other self-assigned source layer-2 ID in use for a simultaneous 5G ProSe direct discovery procedure over PC5 with a different discovery model as specified in clause 6.2.14.2.1.2, clause 6.2.15.2.1.2, clause 8.2.1.2.2.2 and clause 8.2.1.2.4.2.

f) shall pass the resulting PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation 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.

If the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation is used to solicit proximity of a connectivity service provided by a 5G ProSe UE-to-network relay UE, the UE shall ensure that it keeps on passing the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation for transmission until the UE is triggered by an upper layer application to stop soliciting proximity of a connectivity service provided by a 5G ProSe UE-to-network relay UE, or until the UE stops being authorised to perform the discoverer UE procedure for UE-to-network relay discovery. How this is achieved is left up to UE implementation.

NOTE 3: The discoverer UE can stop discoverer UE procedure for UE-to-network relay discovery for power saving by implementation specific means e.g. an implementation-specific maximum number of the UE at a time, or an implementation-specific timer expires.

If the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation is used to trigger the PROSE PC5 DISCOVERY message signal strength measurement between the UE and the 5G ProSe UE-to-network Relay UE with which the UE has a link established, the UE shall start the retransmission timer T5108. If retransmission timer T5108 expires, the UE shall retransmit the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation and restart timer T5108. If no response is received from the ProSe UE-to-network relay UE with which the UE has a link established after reaching the maximum number of allowed retransmissions, the UE shall trigger relay reselection procedure.

NOTE 4: The maximum number of allowed retransmissions is UE implementation specific.

Upon reception of a PROSE PC5 DISCOVERY message for UE-to-network relay discovery response along with the destination layer-2 ID which the UE is configure to respond for, for the target relay service code of the connectivity service which the UE is authorized to discover, the UE shall use the associated DUSK, if received from the 5G DDNMF or 5G PKMF (if security procedure over user plane for 5G ProSe UE-to-network relay is used) 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 received from the 5G DDNMF or 5G PKMF (if security procedure over user plane for 5G ProSe UE-to-network relay is used), 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 received from the 5G DDNMF or 5G PKMF (if security procedure over user plane for 5G ProSe UE-to-network relay is used), 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 response.

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

Then if:

a) the relay service code parameter of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery response is the same as the relay service code parameter of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery solicitation; and

b) the User info ID of the UE-to-network Relay is not configured as specified in clause 5.2.5 for the connectivity service being solicited, or the Discoverer info parameter of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery response is the same as the User info ID of the UE-to-network Relay configured as specified in clause 5.2.5 for the connectivity service being solicited,

then the UE shall consider that the connectivity service or the 5G ProSe layer-2 UE-to-network relay UE the UE seeks to discover has been discovered. In addition, the UE can measure the signal strength of the PROSE PC5 DISCOVERY message for UE-to-network relay discovery response for relay selection or reselection. If the UE has received the PROSE PC5 DISCOVERY message for UE-to-network relay discovery response from the ProSe UE-to-network Relay UE with which the UE has a link established, the UE shall stop the retransmission timer T5108 and start the periodic measurement timer T5108.

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