**3GPP TSG-CT WG1 Meeting #136-eC1-223836**

**E-Meeting, 12th – 20th May 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **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 | **X** |

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| ***Title:***  | Clarification regarding the application identity used in the 5G ProSe direct discovery procedures - ALT. B |
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| ***Source to WG:*** | , Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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:*** | In CT1#135e, it is discussed in C1-222884 that during 5G ProSe direct discovery procedures, the "application identity" is clarified to be the "ProSe identifiers", which is provisioned to UE as specified in clause 5.2.3.**This CR is one alternative implementation of C1-222884**. This CR proposes to replace "application identity" with "ProSe identifier" in the corresponding procedures. The intention of this CR is that the "application identity" is actually not a "ProSe identifier" as implemented in C1-222884. The reason is:As defined in TS 23.303 and TS 24.334 for 4G, the "application identity" (which is called Application ID in stge-2 in TS23.303) is a specific identifier for globally identifying an application in 4G:***Application ID:*** *A globally unique identifier identifying a specific application. This is the identifier used in mobile operating systems by the applications within the mobile operating system. All mobile operating systems have namespaces that identify the applications within the mobile operating system.*And in TS 23.304 for 5G, ProSe identifer is introduced by SA2 to globally identify an application:***ProSe identifier:*** *A globally unique identifier used to identify the ProSe Application associated with the ProSe operation in 5G ProSe Direct Discovery and 5G ProSe Direct Communication. In this Release, the “Application ID” defined in TS 23.303 [3] can be used as the ProSe identifier in 5G ProSe Direct Discovery and in a consequent 5G ProSe Direct Communication.*According to the definition of ProSe identifier, it is clear that, in some cases (e.g. UE performs standalone discovery, or UE performs discovery and in a consequent communication), the value of ProSe identifier is euqal to "application identity", but in some cases (e.g. UE performs standalone communication), the value of ProSe identifer maybe not equal to the "application identity". Hence, to state the "application identity" (i.e. the identifier defined in 4G) is a "ProSe identifier" (i.e. the identifier defined in 5G) would lead to unnecessary misunderstanding.So this CR proposes to replace the "application identity" with the "ProSe identifier" in the corresponding clauses. |
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| ***Summary of change:*** | Replacing the "application identity" with the "ProSe identifier" in the corresponding clauses. |
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| ***Consequences if not approved:*** | Unnecessary misunderstanding of "application identity" to be a "ProSe identifier". |
|  |  |
| ***Clauses affected:*** | 6.2.2.2, 6.2.2.3, 6.2.2.5, 6.2.3.2, 6.2.3.3, 6.2.3.5, 6.2.4.2, 6.2.4.3, 6.2.4.5, 6.2.5.2, 6.2.5.3, 6.2.5.5, 6.2.6.2, 6.2.6.3, 6.2.6.5, 6.2.7.2, 6.2.7.3, 6.2.7.5, 6.2.9.2, 6.2.9.3, 6.2.10.2, 6.2.10.3, 6.2.13.3, 6.2.14.2.2.2, 6.2.14.2.2.3, 6.2.14.2.2.4, 6.2.14.2.2.5, 11.4.2.5 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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\* \* \* First Change \* \* \* \*

#### 6.2.2.2 Announce request procedure initiation

Before initiating the announce request procedure for open 5G ProSe direct discovery, the UE is configured with the data structure of the ProSe application IDs appropriate for its HPLMN. This step is performed using mechanisms out of scope of 3GPP.

If the UE is authorized to perform open 5G ProSe direct discovery announcing in the PLMN operating the radio resources signalled from the serving PLMN, it shall initiate an announce request procedure:

a) when the UE is triggered by an upper layer application to announce a ProSe application ID and the UE has no valid corresponding ProSe application code for that upper layer application;

b) when the validity timer T5060 assigned by the 5G DDNMF to a ProSe application code has expired and the request from upper layers to announce the ProSe application ID corresponding to that ProSe application code is still in place;

c) when the UE selects a new PLMN while announcing a ProSe application code and intends to announce in the new PLMN, and the UE is authorized for open 5G ProSe direct discovery announcing in the new PLMN;

d) when, while announcing a ProSe application ID, the UE intends to switch the announcing PLMN to a different PLMN without performing PLMN selection, and the UE does not have a valid allocated ProSe application code for this new PLMN yet;

e) when the UE needs to inform the 5G DDNMF that the UE wants to stop announcing a ProSe application code; or

f) when the UE needs to update metadata associated with a ProSe application ID to the 5G DDNMF.

When the UE selects a new PLMN while announcing a ProSe application code and the UE is not yet authorized for open 5G ProSe direct discovery announcing in the new PLMN, the UE shall initiate an announce request procedure only after the UE is authorized for open 5G ProSe direct discovery announcing in the new PLMN.

NOTE 1: To ensure service continuity if the UE needs to keep announcing a ProSe application code corresponding to the same ProSe application ID, the UE can initiate the announce request procedure before the validity timer T5060 assigned by the 5G DDNMF for a Prose application code expires.

The UE shall initiate the announce request procedure for open 5G ProSe direct discovery by sending a DISCOVERY\_REQUEST message with:

a) a new transaction ID;

b) the ProSe application ID set to the ProSe application ID received from upper layers;

c) the command set to "metadata\_update" if the UE has a valid ProSe application code corresponding to the ProSe application ID and intends to update metadata associated with the ProSe application ID to the 5G DDNMF, otherwise set to "announce";

d) the UE identity set to the UE's SUPI;

e) the application identity set to the ProSe identifier of the upper layer application that requested the announcing as specified in clause 5.2.3;

f) the discovery entry ID set to 0 when this is a new request or set to the discovery entry ID received from the 5G DDNMF if the announce request is to update a previously sent announce request;

g) the ACE enabled indicator set to "application-controlled extension enabled" if application-controlled extension is required by the upper layers or "normal" if application-controlled extension is not used;

h) optionally the requested timer set to the length of validity timer associated with the ProSe application code that the UE expects to receive from the 5G DDNMF;

i) optionally the Metadata set to the metadata received from upper layers associated with the ProSe application ID; and

j) optionally the announcing PLMN ID set to the PLMN ID of the local PLMN operating the radio resources that the UE intends to use for announcing this ProSe application ID.

If open 5G ProSe direct discovery with application-controlled extension is requested by upper layers, the DISCOVERY\_REQUEST message shall also include the application level container, which contains application-level data transparent to the 3GPP network, to be used by the ProSe application server e.g., to assign ProSe application code suffix(es).

When the UE initiates the announce request procedure to inform the 5G DDNMF that the UE wants to stop announcing a ProSe application code before the associated valid timer expires, the UE shall set the requested timer to 0.

NOTE 2: A UE can include one or multiple transactions in one DISCOVERY\_REQUEST message for different ProSe application IDs, and receive corresponding <response-announce> element or <response-reject> element in a DISCOVERY\_RESPONSE message for each respective transaction. In the following description of the announce request procedure, only one transaction is included.

Figure 6.2.2.2.1 illustrates the interaction of the UE and the 5G DDNMF in the announce request procedure.



Figure 6.2.2.2.1: Announce request procedure

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

#### 6.2.2.3 Announce request procedure accepted by the 5G DDNMF

Upon receiving a DISCOVERY\_REQUEST message with the command set to "announce", if the requested timer is included in the DISCOVERY\_REQUEST message and the requested timer is set to 0, the 5G DDNMF shall check whether there is an existing UE context containing the discovery entry identified by the discovery entry ID included in the DISCOVERY\_REQUEST message. If the discovery entry exists in the UE context, the 5G DDNMF shall inform the 5G DDNMF in the announcing PLMN to remove the corresponding discovery entry as specified in 3GPP TS 29.555 [9] when the announcing PLMN is not the same as that of the PLMN to which the 5G DDNMF belongs and remove the discovery entry identified by the discovery entry ID from the UE's context. Then the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-announce> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message; and

b) the discovery entry ID set to the identifier associated with the corresponding discovery entry.

Upon receiving a DISCOVERY\_REQUEST message with the command set to "announce", if the requested timer is not included in the DISCOVERY\_REQUEST message or the requested timer included in the DISCOVERY\_REQUEST message is not set to 0, the 5G DDNMF shall perform the following procedure.

The 5G DDNMF shall check that the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is authorized for open 5G ProSe direct discovery announcing. If the application is authorized for open 5G ProSe direct discovery announcing, the 5G DDNMF may also check whether the ProSe application ID contained in the DISCOVERY\_REQUEST message is known. If the ProSe application ID is known or the 5G DDNMF skips the check of the ProSe application ID, the 5G DDNMF shall check whether there is an existing context for the UE associated with the requested ProSe application ID.

If there is no associated UE context, the 5G DDNMF checks with the UDM whether the UE is authorized for open 5G ProSe direct discovery announcing as described in 3GPP TS 29.503 [10]. If the check indicates that the UE is authorized then:

a) the 5G DDNMF shall check whether the UE is authorized to announce the ProSe application ID contained in the DISCOVERY\_REQUEST message;

b) if the UE is authorized to announce the ProSe application ID, the ACE enabled indicator is included and set to "application-controlled extension enabled", the application level container is included in the DISCOVERY\_REQUEST message and the requested application uses application-controlled extension, the 5G DDNMF shall check whether the UE is authorized to use ACE. If the UE is authorized for ACE, the 5G DDNMF shall invoke the procedure described in 3GPP TS 29.557 [19] to check whether the UE is authorized to announce the requested ProSe application ID with application-defined suffix(es), and obtain suffix-related information from the ProSe application server. The 5G DDNMF shall then allocate one ProSe application code prefix and a value for validity timer T5060 to be used with the ProSe application code suffix(es) obtained from the ProSe application server for the given ProSe application ID as specified in 3GPP TS 29.557 [19]. The 5G DDNMF may take into account the requested timer if contained in the DISCOVERY\_REQUEST message;

c) if the UE is authorized to announce the ProSe application ID, the ACE enabled indicator is included and set to "normal" in the DISCOVERY\_REQUEST message and the requested application does not use application-controlled extension, the 5G DDNMF shall allocate the corresponding ProSe application code(s) and a value for validity timer T5060. The 5G DDNMF may take into account the requested timer if contained in the DISCOVERY\_REQUEST message;

d) if the UE is authorized to announce the ProSe application ID, the ACE enabled indicator is set included and to "normal" in the DISCOVERY\_REQUEST message, the application level container is included in the DISCOVERY\_REQUEST and the requested application only uses application-controlled extension, the 5G DDNMF shall check whether the UE is authorized to use ACE. If the UE is authorized for ACE, 5G DDNMF shall invoke the procedure described in 3GPP TS 29.557 [19] to check whether the UE is authorized to announce the requested ProSe application ID with application-defined suffix(es), and obtain suffix-related information from the ProSe application server. The 5G DDNMF shall then allocate one ProSe application code prefix and a value for validity timer T5060 to be used with the ProSe application code suffix(es) obtained from the ProSe application server for the given ProSe application ID as specified in 3GPP TS 29.557 [19]. The 5G DDNMF may take into account the requested timer if contained in the DISCOVERY\_REQUEST message;

e) if the UE is authorized to announce the ProSe application ID, the ACE enabled indicator is included and set to "application-controlled-extension enabled" and the application level container is included in the DISCOVERY\_REQUEST message but the requested application does not use application-controlled extension, the 5G DDNMF shall allocate the corresponding ProSe application code(s) and a value for validity timer T5060. The 5G DDNMF may consider the requested timer if contained in the DISCOVERY\_REQUEST message; and

f) if the UE is authorized to announce the ProSe application ID and the ACE enabled indicator is not included in the DISCOVERY\_REQUEST message, the 5G DDNMF shall allocate the corresponding ProSe application code(s) and a value for validity timer T5060. The 5G DDNMF may consider the requested timer if contained in the DISCOVERY\_REQUEST message.

NOTE: The 5G DDNMF can allocate multiple ProSe application codes for a given ProSe application ID for instance in the case when one or more labels in the ProSe application ID name are wild carded as described in clause 24.2.2 of 3GPP TS 23.003 [12].

If the requested ProSe application ID is country-specific or global as described in clause 24.2 of 3GPP TS 23.003 [12], the 5G DDNMF shall allocate the corresponding ProSe application code(s) or ProSe application code prefix according to clause 24.3 of 3GPP TS 23.003 [12]. The temporary identity part of each ProSe application code or ProSe application code prefix is taken from the data structure corresponding to the country-specific or global ProSe application ID namespace according to clause 24.3 of 3GPP TS 23.003 [12]. The 5G DDNMF shall use the MCC and MNC of the PLMN ID of this 5G DDNMF for the PLMN ID part of the ProSe application code or ProSe application code prefix.

After the ProSe application code(s) or ProSe application code prefix allocation, the 5G DDNMF then associates the ProSe application code(s) or ProSe application code prefix with a new discovery entry identified by a non-zero value discovery entry ID in the new context for the UE that contains the UE's subscription parameters obtained from the UDM, and starts timer T5061. The UDM also provides to the 5G DDNMF the PLMN ID of the PLMN in which the UE is currently registered. For a given set of ProSe application codes or the allocated ProSe application code prefix, timer T5061 shall be longer than timer T5060. By default, the value of timer T5061 is 4 minutes greater than the value of timer T5060.

If there is an existing context for the UE that contains the UE's subscription parameters obtained from the UDM, but no discovery entry identified by the discovery entry ID contained in the DISCOVERY\_REQUEST message, the 5G DDNMF shall behave as if the discovery entry ID included in the DISCOVERY\_REQUEST message was set to 0, and the 5G DDNMF shall allocate a new non-zero discovery entry ID for this entry.

If the metadata is included in the DISCOVERY\_REQUEST message, the 5G DDNMF shall allocate the ProSe application code or ProSe application code prefix including a metadata index to indicate the current version of the metadata, and store the received metadata in the UE context.

Moreover, if the command is set to "metadata\_update" in the DISCOVERY\_REQUEST message and there is an existing UE context stored in the 5G DDNMF, the 5G DDNMF shall update the metadata in the UE context by using the received metadata in the DISCOVERY\_REQUEST message, and update the ProSe application code or ProSe application code prefix in the UE context by changing the metadata index portion and keeping the rest unchanged.

After the ProSe application code(s) allocation, the 5G DDNMF then associates the ProSe application code(s) with a new discovery entry identified by a non-zero value discovery entry ID in the UE context, and starts timer T5061.

If there is an existing context for the UE and a discovery entry identified by the discovery entry ID contained in the DISCOVERY\_REQUEST message associated with the requested ProSe application ID, the 5G DDNMF shall either update the discovery entry with a new validity timer T5060, or allocate new ProSe application code(s) or ProSe application code prefix for the requested ProSe application ID with a new validity timer T5060, and restart timer T5061. The 5G DDNMF may consider the requested timer if contained in the DISCOVERY\_REQUEST message.

If a new discovery entry was created or an existing discovery entry was updated and the UE is currently roaming or the Announcing PLMN ID is included in the DISCOVERY\_REQUEST message, the 5G DDNMF checks with the 5G DDNMF of the VPLMN or in case of open 5G ProSe direct discovery the local PLMN identified by the Announcing PLMN ID whether the UE is authorized for open 5G ProSe direct discovery announcing as described in 3GPP TS 29.555 [9].

If the check indicates that the UE is authorized, then the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-announce> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message from the UE;

b) either the ProSe application code(s) set to the ProSe application code(s) allocated by the 5G DDNMF, or the ProSe application code ACE parameter set to include the ProSe-application code- prefix allocated by the 5G DDNMF, and one or more ProSe application code suffix Ranges which contain the suffix(es) for the ProSe application ID received in the DISCOVERY\_REQUEST message from the UE;

c) validity timer T5060 set to the T5060 timer value assigned by the 5G DDNMF to the ProSe application code(s):

d) if the ACE enabled indicator was included by the UE in the DISCOVERY\_REQUEST message, the ACE enabled indicator set to:

1) "application-controlled extension enabled" if application-controlled extension is used; or

2) "normal" if application-controlled extension is not used;

e) the discovery entry ID set to the identifier associated with the corresponding discovery entry;

f) the discovery key set to a value provided by the 5G DDNMF; and

g) the current time set to the current UTC-based time at the 5G DDNMF and the max offset.

If timer T5061 expires, the 5G DDNMF shall remove the discovery entry identified by the discovery entry ID from the UE's context.

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

#### 6.2.2.5 Announce request procedure not accepted by the 5G DDNMF

If the DISCOVERY\_REQUEST message cannot be accepted by the 5G DDNMF, the 5G DDNMF sends a DISCOVERY\_RESPONSE message containing a <response-reject> element to the UE including an appropriate PC3a control protocol cause value.

If the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is not authorized for open 5G ProSe direct discovery announcing, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

If the ProSe application ID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #2 "Unknown ProSe application ID".

If the UE is not authorized for open 5G ProSe direct discovery announcing, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorization failure".

If the UE is not authorized to use the ProSe application ID contained in the DISCOVERY\_REQUEST message, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorization failure".

If the UE requests a country-specific ProSe application ID for a country that does not correspond to the country of its HPLMN, and the 5G DDNMF has not authorized the UE to announce in that country, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #8 "Scope violation in Prose application ID".

If the UE requests a country-specific ProSe application ID for a country that does not correspond to the country of its HPLMN, and the 5G DDNMF has no agreement to access the country-wide ProSe application ID database of that country, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #8 "Scope violation in Prose application ID".

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF and the requested timer is set to zero, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value # 10 "Unknown or invalid discovery entry ID".

If the UE is not authorized to use ACE, but the DISCOVERY\_REQUEST message contains the ACE enabled indicator set to "application-controlled extension enabled", the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #12 "UE unauthorized for discovery with application-controlled extension".

If the DISCOVERY\_REQUEST message contains the ACE enabled indicator set to "application-controlled extension enabled", but does not contain the application level container parameter, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #14 "Missing application level container".

If the ProSe application server indicates to the 5G DDNMF that the application level container in the DISCOVERY\_REQUEST message contains invalid information, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #15 "Invalid data in application level container".

If the DISCOVERY\_REQUEST message does not contain the ACE enabled indicator and the requested application only uses application-controlled extension, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

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

#### 6.2.3.2 Announce request procedure initiation

Before initiating the announce request procedure, the user sets the permissions for the restricted discovery using application layer mechanisms. The application client in the UE retrieves the PDUID provisioned to the UE as part of the service authorization procedure as specified in clause 5 and obtains an RPAUID associated with the UE's PDUID from the ProSe application server. The UE may provide metadata to be associated with the RPAUID, and the ProSe application server stores the metadata. This step is performed using mechanisms that are out of scope of the present specification.

If the UE is authorized to perform restricted 5G ProSe direct discovery model A announcing in the PLMN operating the radio resources signalled from the serving PLMN, it shall initiate an announce request procedure:

a) when the UE is triggered by an upper layer application to announce an RPAUID and the UE has no valid corresponding ProSe restricted code for that RPAUID of the upper layer application;

b) when the validity timer T5062 assigned by the 5G DDNMF to a ProSe restricted code has expired and the request from upper layers to announce the RPAUID corresponding to that ProSe restricted code is still in place;

c) when the UE selects a new PLMN while announcing a ProSe restricted code and intends to announce in the new PLMN, and the UE is authorized for restricted 5G ProSe direct discovery model A announcing in the new PLMN;

d) when, while announcing a RPAUID, the UE intends to switch the announcing PLMN to a different PLMN without performing PLMN selection, and the UE does not have a valid allocated ProSe restricted code for this new PLMN yet; or

e) when the UE needs to update a previously sent restricted 5G ProSe direct discovery model A announcing request.

When the UE selects a new PLMN while announcing a ProSe restricted code and the UE is not yet authorized for restricted 5G ProSe direct discovery model A announcing in the new PLMN, the UE shall initiate an announce request procedure only after the UE is authorized for restricted 5G ProSe direct discovery model A announcing in the new PLMN.

NOTE 1: To ensure service continuity if the UE needs to keep announcing a ProSe restricted code corresponding to the same RPAUID, the UE can initiate the announce request procedure before the validity timer T5062 assigned by the 5G DDNMF for a ProSe restricted code expires.

The UE shall initiate the announce request procedure by sending a DISCOVERY\_REQUEST message with:

a) a new transaction ID not used in any other direct discovery procedures in PC3a interface;

b) the RPAUID set to the RPAUID received from upper layers;

c) the command set to "announce";

d) the UE identity set to the UE's SUPI;

e) the application identity set to the ProSe identifier of the upper layer application that requested the announcing as specified in clause 5.2.3;

f) the discovery type set to "Restricted discovery";

g) the ACE enabled indicator set to "application-controlled extension enabled" if application-controlled extension is required by the upper layers or "normal" if application-controlled extension is not used;

h) the announcing type set to "on demand" if on demand announcing is requested by upper layers and "normal" if on demand announcing is not requested by upper layers;

i) optionally the requested timer set to the length of validity timer associated with the ProSe restricted code that the UE expects to receive from the 5G DDNMF;

j) the discovery entry ID set to a 0 if the announcing request is a new request, and set to the discovery entry ID received from the 5G DDNMF if the announcing request is to update a previously sent announcing request; and

k) optionally the announcing PLMN ID set to the PLMN ID of the local PLMN operating the radio resources that the UE intends to use for announcing the RPAUID.

If restricted 5G ProSe direct discovery model A with application-controlled extension is requested by upper layers, the DISCOVERY\_REQUEST message shall also include the application level container, which contains application-level data transparent to the 3GPP network, to be used by the ProSe application server e.g., to assign ProSe restricted code suffix(es).

When the UE initiates the announce request procedure to inform the 5G DDNMF that the UE wants to stop announcing a ProSe restricted code before the associated valid timer expires, the UE shall set the requested timer to 0.

NOTE 2: A UE can include one or multiple transactions in one DISCOVERY\_REQUEST message for different RPAUIDs, and receive corresponding <restricted-announce-response> element or <response-reject> element in a DISCOVERY\_RESPONSE message for each respective transaction. In the following description of the announce request procedure, only one transaction is included.

Figure 6.2.3.2.1 illustrates the interaction of the UE and the 5G DDNMF in the announce request procedure.



Figure 6.2.3.2.1: Announce request procedure for restricted 5G ProSe direct discovery model A

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

#### 6.2.3.3 Announce request procedure accepted by the 5G DDNMF

Upon receiving a DISCOVERY\_REQUEST message with the command set to "announce" and the discovery type set to "Restricted discovery", if the requested timer is included in the DISCOVERY\_REQUEST message and the requested timer is set to 0, the 5G DDNMF shall check whether there is an existing UE context containing the discovery entry identified by the discovery entry ID included in the DISCOVERY\_REQUEST message. If the discovery entry exists in the UE context, the 5G DDNMF shall inform the 5G DDNMF in the announcing PLMN to remove the corresponding discovery entry as specified in 3GPP TS 29.555 [9] when the announcing PLMN is not the same as that of the PLMN to which the 5G DDNMF belongs and remove the discovery entry identified by the discovery entry ID from the UE's context.

Upon receiving a DISCOVERY\_REQUEST message with the command set to "announce" and the discovery type set to "Restricted discovery", if the requested timer is not included in the DISCOVERY\_REQUEST message or the requested timer included in the DISCOVERY\_REQUEST message is not set to 0, the 5G DDNMF shall perform the following procedure.

The 5G DDNMF shall check that the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is authorized for restricted 5G ProSe direct discovery model A announcing. If the application is authorized for restricted 5G ProSe direct discovery model A announcing, the 5G DDNMF shall check whether there is an existing context for the UE.

If there is no associated UE context, the 5G DDNMF checks with the UDM whether the UE is authorized for restricted 5G ProSe direct discovery model A announcing as described in 3GPP TS 29.503 [10]. If the check indicates that the UE is authorized, the 5G DDNMF creates a UE context that contains the UE's subscription parameters obtained from the UDM. The UDM also provides to the 5G DDNMF the PLMN ID of the PLMN in which the UE is currently registered. If the UE context exists, the 5G DDNMF shall then check whether the UE is authorized for restricted 5G ProSe direct discovery model A announcing in the currently registered PLMN or in the local PLMN identified by the Announcing PLMN ID included in the DISCOVERY\_REQUEST message.

If the UE is authorized and the discovery entry ID included in the DISCOVERY\_REQUEST message is set to 0 then:

a) the 5G DDNMF shall check whether the UE is authorized to announce the RPAUID contained in the DISCOVERY\_REQUEST message. Optionally this can include checking with the ProSe application server as described in 3GPP TS 29.557 [19] to obtain the binding between the RPAUID and PDUID, and then verifying that the PDUID belongs to the requesting UE;

b) if the UE is authorized to announce the RPAUID, the ACE enabled indicator is set to "application-controlled extension enabled", the application level container is included in the DISCOVERY\_REQUEST message and the requested application uses application-controlled extension, the 5G DDNMF shall check whether the UE is authorized to use ACE. If the UE is authorized for ACE, the 5G DDNMF shall invoke the procedure described in 3GPP TS 29.557 [19] to check whether the UE is authorized to announce the requested RPAUID with application-defined suffix(es), and obtain suffix-related information from the ProSe application server. The 5G DDNMF shall then allocate a ProSe restricted code prefix and a value for validity timer T5062 to be used with the ProSe restricted code suffix(es) obtained from the ProSe application server for the given RPAUID as specified in 3GPP TS 29.557 [19]. The 5G DDNMF may take into account the requested timer if contained in the DISCOVERY\_REQUEST message when allocating validity timer T5062;

c) if the UE is authorized to announce the RPAUID, the ACE enabled indicator is set to "normal" in the DISCOVERY\_REQUEST message and the requested application does not use application-controlled extension, the 5G DDNMF shall allocate the corresponding ProSe restricted code and a value for validity timer T5062. The 5G DDNMF may take into account the requested timer if contained in the DISCOVERY\_REQUEST message when allocating validity timer T5062;

d) if the UE is authorized to announce the RPAUID, the ACE enabled indicator is set to "normal" in the DISCOVERY\_REQUEST message, the application level container is included in the DISCOVERY\_REQUEST and the requested application only uses application-controlled extension, the 5G DDNMF shall check whether the UE is authorized to use ACE. If the UE is authorized for ACE, the 5G DDNMF shall invoke the procedure described in 3GPP TS 29.557 [19] to check whether the UE is authorized to announce the requested RPAUID with application-defined suffix(es), and obtain suffix-related information from the ProSe application server. The 5G DDNMF shall then allocate a ProSe restricted code prefix and a value for validity timer T5062 to be used with the ProSe restricted code suffix(es) obtained from the ProSe application server for the given RPAUID as specified in 3GPP TS 29.557 [19] The 5G DDNMF may consider the requested timer if contained in the DISCOVERY\_REQUEST message when allocating validity timer T5062;

e) if the UE is authorized to announce the RPAUID, the ACE enabled indicator is set to "application-controlled-extension enabled" and the application level container is included in the DISCOVERY\_REQUEST message but the requested application does not use application-controlled extension, the 5G DDNMF shall allocate the corresponding ProSe restricted code and a value for validity timer T5062. The 5G DDNMF may consider the requested timer if contained in the DISCOVERY\_REQUEST message when allocating validity timer T5062; and

f) the 5G DDNMF associates the allocated ProSe restricted code or ProSe restricted code prefix with a new discovery entry in the UE's context, and starts timer T5063. The UDM also provides to the 5G DDNMF the PLMN ID of the PLMN in which the UE is currently registered. For a given ProSe restricted code, timer T5063 shall be longer than timer T5062. By default, the value of timer T5063 is 4 minutes greater than the value of timer T5062.

If the discovery entry ID included in the DISCOVERY\_REQUEST message is not set to 0 and if there is an existing discovery entry for this discovery entry ID value in the UE's context, the 5G DDNMF shall either update the discovery entry with a new validity timer T5062, or allocate a new ProSe restricted code or ProSe restricted code prefix for the requested RPAUID with a new validity timer T5062, restart timer T5063, and clear any existing on demand announcing enabled indicator. The 5G DDNMF may consider the requested timer if contained in the DISCOVERY\_REQUEST message when allocating validity timer T5062.

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is not found in the UE context or there is no UE context in the 5G DDNMF, the 5G DDNMF shall behave as if the discovery entry ID included in the DISCOVERY\_REQUEST message was set to 0, and the 5G DDNMF shall allocate a new non-zero discovery entry ID for this entry.

If the announcing type is set to "on demand" in the DISCOVERY\_REQUEST message, the 5G DDNMF shall check if "on demand" announcing is authorized and enabled based on the ProSe identifier and the operator's policy. If "on demand" announcing is authorized and enabled, and there is no ongoing monitoring request for this RPAUID, then the 5G DDNMF shall set the on demand announcing enabled indicator to 1 for the corresponding discovery entry in the UE's context.

If a new UE context was created or an existing UE context was updated, and the UE is currently roaming or the announcing PLMN ID is included in the DISCOVERY\_REQUEST message, and the on demand announcing enabled indicator is not set to 1 for this discovery entry in the UE's context, the 5G DDNMF checks with the 5G DDNMF of the VPLMN or the local PLMN represented by the Announcing PLMN ID whether the UE is authorized for restricted 5G ProSe direct discovery model A announcing as described in 3GPP TS 29.555 [9].

The 5G DDNMF shall then send a DISCOVERY\_RESPONSE message containing a <restricted-announce-response> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message from the UE;

b) if the on demand announcing enabled indicator is not set to 1 in the UE's context for this discovery entry, either the ProSe restricted code set to the ProSe restricted code or the ProSe restricted code prefix allocated by the 5G DDNMF, and optionally one or more ProSe restricted code suffix Ranges which contain the suffix(es) for the RPAUID received in the DISCOVERY\_REQUEST message;

c) a validity timer T5062 set to the T5062 timer value assigned by the 5G DDNMF to the ProSe restricted code;

d) the ACE enabled indicator set to "application-controlled extension enabled" if application-controlled extension is used, or "normal" if application-controlled extension is not used;

e) the code-sending security parameter containing the security-related information for the UE to protect the transmission of the ProSe restricted code;

f) the on demand announcing enabled indicator indicating whether the on demand announcing is enabled or not for this discovery entry if the announcing type is set to "on demand" in the DISCOVERY\_REQUEST message;

g) the discovery entry ID set to the ID of the discovery entry associated with this announce request in the UE's context;

h) the current time set to the current UTC-based time at the 5G DDNMF and the max offset; and

i) optionally, the PC5 security policies used for 5G ProSe direct link establishment procedure.

If timer T5063 expires, the 5G DDNMF shall remove the discovery entry associated with the corresponding RPAUID from the UE's context.

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

#### 6.2.3.5 Announce request procedure not accepted by the 5G DDNMF

If the DISCOVERY\_REQUEST message cannot be accepted by the 5G DDNMF, the 5G DDNMF sends a DISCOVERY\_RESPONSE message containing a <response-reject> element to the UE including an appropriate PC3a control protocol cause value.

If the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is not authorized for ProSe direct discovery announcing, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

If the RPAUID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF or ProSe application server, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #9 "Unknown RPAUID".

If the RPAUID contained in the DISCOVERY\_REQUEST message does not match the stored RPAUID for the requested discovery entry ID, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #10 "Unknown or invalid discovery entry ID".

If the UE is not authorized for restricted 5G ProSe direct discovery model A announcing, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorization failure".

If the UE is not authorized for restricted "on demand" restricted 5G ProSe direct discovery model A announcing, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #13 "UE unauthorized for on-demand announcing".

If the RPAUID contained in the DISCOVERY\_REQUEST message is not associated with the PDUID belonging to the requesting UE, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorization Failure".

If the UE is not authorized to use ACE, but the DISCOVERY\_REQUEST message contains the ACE enabled indicator set to "application-controlled extension enabled", the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #12 "UE unauthorized for discovery with application-controlled extension".

If the DISCOVERY\_REQUEST message contains the ACE enabled indicator set to "application-controlled extension enabled", but does not contain the application level container parameter, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #14 "Missing application level container".

If the ProSe application server indicates to the 5G DDNMF that the application level container in the DISCOVERY\_REQUEST message contains invalid information, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #15 "Invalid data in application level container".

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF and the requested timer is set to zero, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value # 10 "Unknown or invalid discovery entry ID".

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

#### 6.2.4.2 Monitor request procedure Initiation

Before initiating the monitor request procedure, the UE is configured with the data structure of the ProSe application IDs it wants to monitor. This step is performed using mechanisms that are out of scope of 3GPP.

If the UE is authorized to perform open 5G ProSe direct discovery monitoring in at least one PLMN, it shall initiate a monitor request procedure:

a) when the UE is triggered by an upper layer application to perform open 5G ProSe direct discovery monitoring corresponding to a ProSe application ID and the UE has no valid discovery filters corresponding to the requested ProSe application ID for that upper layer application;

b) when the TTL timer T5064 assigned by the 5G DDNMF to a discovery filter has expired and the request from upper layers to monitor that ProSe application ID is still in place; or

c) when the UE needs to inform the 5G DDNMF that the UE wants to stop using discovery filters for direct discovery monitoring.

NOTE 1: To ensure service continuity if the UE needs to keep monitoring the same discovery filter, the UE can initiate the monitor request procedure before the TTL timer T5064 assigned by the 5G DDNMF for a discovery filter expires.

The UE shall initiate the monitor request procedure for open 5G ProSe direct discovery by sending a DISCOVERY\_REQUEST message with:

a) a new transaction ID;

b) the ProSe application ID set to the ProSe application ID received from upper layers;

c) the command set to "monitor"

d) the UE identity set to the UE's SUPI;

e) the application identity set to the ProSe identifier of the upper layer application that requested the monitoring as specified in clause 5.2.3;

f) the ACE enabled indicator set to "application-controlled extension enabled" if application-controlled extension is required by the upper layers, or "normal" if application-controlled extension is not used;

g) the discovery entry ID set to 0 if this is a new request or set to the discovery entry ID received from the 5G DDNMF if the monitor request is to update a previously sent monitor request; and

h) optionally, the requested timer set to 0 only when the UE wants to stop using discovery filters for direct discovery monitoring.

If open 5G ProSe direct discovery with application-controlled extension is requested by upper layers, the DISCOVERY\_REQUEST message shall also include the application level container, which contains information corresponding to the ProSe application code suffix, e.g., group or user-specific information.

NOTE 2: A UE can include one or multiple transactions in one DISCOVERY\_REQUEST message for one or more ProSe application IDs, and receive corresponding <response-monitor> element or <response-reject> element in the DISCOVERY\_RESPONSE message for each respective transaction. In the following description of the monitor request procedure, only one transaction is included.

Figure 6.2.4.2.1 illustrates the interaction between the UE and the 5G DDNMF in the monitor request procedure.



Figure 6.2.4.2.1: Monitor request procedure

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

#### 6.2.4.3 Monitor request procedure accepted by the 5G DDNMF

Upon receiving a DISCOVERY\_REQUEST message with the command set to "monitor", if the requested timer is included in the DISCOVERY\_REQUEST message and the requested timer is set to 0, the 5G DDNMF shall check whether there is an existing UE context containing the discovery entry identified by the discovery entry ID included in the DISCOVERY\_REQUEST message. If the discovery entry exists in the UE context, the 5G DDNMF shall remove the discovery entry identified by the discovery entry ID from the UE's context. When the associated ProSe application ID is PLMN-specific and that PLMN ID indicated by the ProSe application ID is not the same as that of the PLMN to which the 5G DDNMF belongs, the 5G DDNMF shall inform the 5G DDNMF in the PLMN indicated by the ProSe application ID to remove the corresponding discovery entry as specified in 3GPP TS 29.555 [9]. Then the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-monitor> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message; and

b) the discovery entry ID set to the value of the discovery entry ID received in the DISCOVERY\_REQUEST message.

Upon receiving a DISCOVERY\_REQUEST message with the command set to "monitor", if the requested timer is not included in the DISCOVERY\_REQUEST message, the 5G DDNMF shall perform the following procedure.

The 5G DDNMF shall check that the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is authorized for open 5G ProSe direct discovery monitoring. If the application is authorized for open 5G ProSe direct discovery monitoring, the 5G DDNMF checks whether there is an existing context for the UE associated with the requested ProSe application ID.

If there is no associated UE context, the 5G DDNMF checks with the UDM whether the UE is authorized for open 5G ProSe direct discovery monitoring as described in 3GPP TS 29.503 [10]. The UDM provides to the 5G DDNMF the PLMN ID of the PLMN in which the UE is currently registered. If the subscription check indicates that the UE is authorized, the 5G DDNMF creates a new context for the UE and a new discovery entry identified by a non-zero value discovery entry ID which is associated with the requested ProSe application ID.

If the ACE enabled indicator in the DISCOVERY\_REQUEST message is included and set to "application-controlled extension enabled" and the requested application uses application-controlled extension, the 5G DDNMF shall check whether the UE is authorized to use ACE. If the UE is authorized for ACE, the 5G DDNMF shall also use the procedure described in 3GPP TS 29.557 [19] to obtain the mask(s) for monitoring the ProSe application code suffix (es) corresponding to the requested ProSe application ID.

If the PLMN ID indicated in the ProSe application ID is PLMN-Specific and that PLMN ID is not the same as that of the PLMN to which the 5G DDNMF belongs, then the 5G DDNMF executes the procedures defined in 3GPP TS 29.555 [9] to obtain the discovery filter(s) for the ProSe application ID. Otherwise, the 5G DDNMF shall allocate one or more discovery filters for the requested ProSe application ID if it is known to the 5G DDNMF, and at least one corresponding valid ProSe application code or ProSe application code prefix is available in the 5G DDNMF. Each discovery filter consists of a ProSe application code, one or more ProSe application masks, and a TTL timer T5064. If application-controlled extension is used, the allocated Discovery Filter shall be applicable to match both prefix and suffix portions of the ProSe application code.

If the requested ProSe application ID is country-specific or global or PLMN-specific as defined respectively in clause 24.2 of 3GPP TS 23.003 [12], the 5G DDNMF shall allocate the discovery filter which contains ProSe application code and ProSe application mask(s) in the corresponding scope. If the ProSe application ID is country-specific or global, the ProSe application mask(s) enclosed in the discovery filter hides the PLMN ID part correspondingly and the temporary identity part is taken from the data structure corresponding to the global or country-wide ProSe application ID namespace, as specified in clause 24.3 of 3GPP TS 23.003 [12]. If the requested ProSe application ID is PLMN-specific, the 5G DDNMF shall allocate one or more PLMN-specific discovery filters. Each of these discovery filters shall contain a PLMN-specific Prose application code and the ProSe application mask(s) whose PLMN ID portion shall be set such that when the mask is applied to the ProSe application code, the outcome matches the full PLMN ID of that specific PLMN.

After the discovery filter(s) are allocated, the 5G DDNMF then associates the discovery filters with the new discovery entry in the UE context and starts timer T5065 assigned for each discovery filter. For a given discovery filter timer T5065 shall be longer than timer T5064. By default, the value of timer T5065 is 4 minutes greater than the value of timer T5064.

If there is an existing context for the UE that contains the UE's subscription parameters obtained from the UDM, but no discovery entry identified by the discovery entry ID contained in the DISCOVERY\_REQUEST message, the 5G DDNMF shall check whether the UE is authorized for ProSe direct discovery monitoring. If the UE is authorized, the 5G DDNMF shall allocate the discovery filter as specified above.

After the discovery filter is allocated, the 5G DDNMF then associates the discovery filter with a new discovery entry identified by a non-zero value discovery entry ID in the UE context, and starts timer T5065 assigned for each discovery filter.

Similarly, if there is an existing context and a discovery entry identified by the discovery entry ID contained in the DISCOVERY\_REQUEST message for the UE associated with the requested ProSe application ID, the 5G DDNMF updates the content of discovery filter(s), associate the discovery entry with the updated discovery filter(s) and restart timer T5065 for each filter. The update of a discovery filter content includes setting new TTL timer(s) and if necessary, assigning new ProSe application code or ProSe application code prefix and ProSe application mask(s).

Then the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-monitor> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message from the UE;

b) the discovery entry ID set to the identifier associated with the discovery entry;

c) if the ACE enabled indicator was included by the UE in the DISCOVERY\_REQUEST message, the ACE enabled indicator set to:

1) "application-controlled extension enabled" if application-controlled extension is used; or

2) "normal" if application-controlled extension is not used;

d) one or more discovery filters allocated by the 5G DDNMF(s) for the ProSe application ID received in the DISCOVERY\_REQUEST message from the UE; and

e) the current time set to the current UTC-based time at the 5G DDNMF and the max offset.

If timer T5065 expires, the 5G DDNMF shall remove the UE's association with the corresponding discovery filter. Furthermore, the 5G DDNMF shall remove the discovery entry from the UE's context if there is no discovery filter corresponding to the ProSe application ID.

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

#### 6.2.4.5 Monitor request procedure not accepted by the 5G DDNMF

If the DISCOVERY\_REQUEST message is not accepted by the 5G DDNMF, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element to the UE including an appropriate PC3a control protocol cause value.

If the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is not authorized for open 5G ProSe direct discovery monitoring, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

If the ProSe application ID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #2 "Unknown ProSe application ID".

If the UE is not authorized for open 5G ProSe direct discovery monitoring, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorization failure".

If the UE requests a country-specific ProSe application ID for a country that does not correspond to the country of its HPLMN, and the 5G DDNMF has not authorized the UE to monitor in that country, it shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #8 "Scope violation in Prose application ID".

If the UE requests a country-specific ProSe application ID for a country that does not correspond to the country of its HPLMN, and the 5G DDNMF has no agreement to access the country-specific ProSe application ID database of that country, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #8 "Scope violation in Prose application ID".

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF and the requested timer is set to 0, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #10 "Unknown or invalid discovery entry ID ".

If the 5G DDNMF cannot retrieve a valid ProSe application code corresponding to the ProSe application ID contained in the DISCOVERY\_REQUEST message, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #17 "No valid ProSe application code".

If the UE is not authorized to use ACE, but the DISCOVERY\_REQUEST message contains the ACE enabled indicator set to "application-controlled extension enabled", the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #12 "UE unauthorized for discovery with application-controlled extension".

If the DISCOVERY\_REQUEST message does not contain the ACE enabled indicator and the requested application only uses application-controlled extension, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

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

#### 6.2.5.2 Monitor request procedure Initiation

Before initiating the monitor request procedure, the user sets the permissions for the restricted discovery using application layer mechanisms. The application client in the UE retrieves the PDUID provisioned to the UE as part of the service authorization procedure as specified in clause 5, and obtains an RPAUID associated with the UE's PDUID and the target RPAUID(s) to be monitored from the ProSe application server. This step is performed using mechanisms that are out of scope of the present specification.

If the UE is authorized to perform ProSe direct discovery model A monitoring in at least one PLMN, it shall initiate a monitor request procedure:

a) when the UE is triggered by an upper layer application to perform restricted 5G ProSe direct discovery model A monitoring corresponding to at least one RPAUID, and the UE has no valid restricted discovery filters corresponding to the requested RPAUID for that upper layer application; or

b) when the TTL timer T5066 assigned by the 5G DDNMF to a Restricted discovery filter has expired and the request from upper layers to monitor that RPAUID is still in place; or

NOTE 1: To ensure service continuity if the UE needs to keep monitoring the same restricted discovery filter, the UE can initiate the monitor request procedure before the TTL timer T5066 assigned by the 5G DDNMF for a Restricted discovery filter expires.

c) when the UE needs to update a previously sent restricted 5G ProSe direct discovery model A monitoring request.

The UE shall initiate the monitor request procedure by sending a DISCOVERY\_REQUEST message with:

a) a new transaction ID;

b) the RPAUID set to the RPAUID received from upper layers;

c) the command set to "monitor";

d) the discovery type set to "Restricted discovery"

e) the UE identity set to the UE's SUPI;

f) the application identity set to the ProSe identifier of the upper layer application that requested the monitoring as specified in clause 5.2.3;

g) the ACE enabled indicator set to "application-controlled extension enabled" if application-controlled extension is required by the upper layers, or "normal" if application-controlled extension is not used;

h) the application level container set to the target RPAUIDs to monitor;

i) the discovery entry ID set to 0 if the monitoring request is a new request, and set to the discovery entry ID received from the 5G DDNMF if the monitoring request is to update a previously sent monitoring request; and

j) optionally, the requested timer set to 0 only when the UE wants to stop using restricted discovery filter(s) for direct discovery monitoring.

If restricted direct discovery model A with application-controlled extension is requested by upper layers, the application level container included in the DISCOVERY\_REQUEST also contains information corresponding to the ProSe restricted code suffix, e.g., group or user-specific information.

NOTE 2: A UE can include one or multiple transactions in one DISCOVERY\_REQUEST message for one or more different monitoring targets, and receive corresponding <response-monitor> element or <response-reject> element in the DISCOVERY\_RESPONSE message for each respective transaction. In the following description of the monitor request procedure, only one transaction is included.

Figure 6.2.5.2.1 illustrates the interaction between the UE and the 5G DDNMF in the monitor request procedure.



Figure 6.2.5.2.1: Monitor request procedure for restricted 5G ProSe direct discovery model A

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

#### 6.2.5.3 Monitor request procedure accepted by the 5G DDNMF

Upon receiving a DISCOVERY\_REQUEST message with the command set to "monitor" and the discovery type set to "Restricted discovery", if the requested timer is included in the DISCOVERY\_REQUEST message and the requested timer is set to 0, the 5G DDNMF shall check whether there is an existing UE context containing the discovery entry identified by the discovery entry ID included in the DISCOVERY\_REQUEST message. If the discovery entry exists in the UE context, the 5G DDNMF shall remove the discovery entry identified by the discovery entry ID from the UE's context. For each of the PDUIDs corresponding to the target RPAUIDs contained the restricted discovery filters in the discovery entry, if the PDUID is PLMN-specific and that PLMN ID indicated by the PDUID is not the same as that of the PLMN to which the 5G DDNMF belongs, the 5G DDNMF shall inform the 5G DDNMF in the PLMN indicated by the PDUID to remove the corresponding discovery entry as specified in 3GPP TS 29.555 [9].

Upon receiving a DISCOVERY\_REQUEST message with the command set to "monitor" and the discovery type set to "Restricted discovery", if the requested timer is not included in the DISCOVERY\_REQUEST message, the 5G DDNMF shall perform the following procedure.

The 5G DDNMF shall check that the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is authorized for ProSe direct discovery model A monitoring. If the application is authorized for restricted 5G ProSe direct discovery model A monitoring, the 5G DDNMF shall check whether there is an existing UE context.

If there is no associated UE context, the 5G DDNMF checks with the UDM whether the UE is authorized for restricted 5G ProSe direct discovery model A monitoring as described in 3GPP TS 29.503 [10]. The UDM provides to the 5G DDNMF the PLMN ID of the PLMN in which the UE is currently registered. If the subscription check indicates that the UE is authorized, the 5G DDNMF creates a new UE context containing the UE's subscription parameters obtained from the UDM.

If the discovery entry ID included in the DISCOVERY\_REQUEST is set to 0 then:

a) the 5G DDNMF shall use the procedure described in 3GPP TS 29.557 [19] to pass the application level container included in the DISCOVERY\_REQUEST message to the ProSe application server and obtain a list of PDUID(s) , an application level container and optionally Metadata Indicator(s) corresponding to the authorized target RPAUID(s) from the ProSe application server;

b) if the ACE enabled indicator in the DISCOVERY\_REQUEST message is set to "application-controlled extension enabled" and the requested application uses application-controlled extension, the 5G DDNMF shall check whether the UE is authorized to use ACE. If the UE is authorized for ACE, the 5G DDNMF shall also use the procedure described in 3GPP TS 29.557 [19] to obtain the mask(s) for monitoring a ProSe restricted suffix pool corresponding to each of the Target RPAUIDs.

NOTE 1: The ProSe application server can reject the request for some of the target RPAUIDs included in the application level container in the DISCOVERY\_REQUEST message because they are ineligible to be monitored by the requesting UE. Depending on the operator policy and application layer permissions, it is possible that only a subset of valid RPAUIDs is authorized by the ProSe application server.

c) for each of the PDUIDs corresponding to an authorized target RPAUID, if the PLMN ID of the PDUID is not the same as that of the PLMN to which the 5G DDNMF belongs, then the 5G DDNMF executes the procedures defined in 3GPP TS 29.555 [9] to obtain the ProSe restricted code or ProSe restricted code prefix for the target RPAUID and creates restricted discovery filter(s). Otherwise, for each target RPAUID, the 5G DDNMF shall allocate one or more restricted discovery filter(s). If the ACE enabled indicator in the DISCOVERY\_REQUEST message does not match the ACE configuration in the 5G DDNMF or ProSe application server for this application, the ACE configuration in the 5G DDNMF or ProSe application server shall be used to create Restricted discovery filter(s). Each Restricted discovery filter consists of a ProSe restricted code, one or more masks, a TTL timer T5066, optionally the target RPAUID, optionally a metadata indicator and optionally metadata associated with this RPAUID;

d) the 5G DDNMF associates the restricted discovery filters with a new discovery entry in the UE's context; and

e) the 5G DDNMF starts timer T5067 assigned for each Restricted discovery filter. For a given restricted discovery filter, timer T5067 shall be longer than timer T5066. By default, the value of timer T5067 is 4 minutes greater than the value of timer T5066.

NOTE 2: For each target RPAUID, the 5G DDNMF either allocates one restricted discovery filter for full-matching the ProSe restricted code assigned to this RPAUID, or allocates one or more restricted discovery filter(s) for matching the ProSe restricted code prefix and suffix pool assigned to this RPAUID.

If the discovery entry ID included in the DISCOVERY\_REQUEST message is not set to 0 and if there is an existing discovery entry for this discovery entry ID in the UE's context, the 5G DDNMF shall check whether the UE is authorized for restricted 5G ProSe direct discovery model A monitoring. If the UE is authorized, the 5G DDNMF shall process the request as above-mentioned and update this discovery entry with the contents of the restricted discovery filter(s) associated with this discovery entry and restart timer T5067(s) for each filter. The update of a restricted discovery filter content includes setting new TTL timer(s) and if necessary, obtaining new ProSe restricted code and ProSe restricted mask(s) via the procedure defined in 3GPP TS 29.555 [9].

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is not found in the UE context or there is no UE context in the 5G DDNMF, the 5G DDNMF shall behave as if the discovery entry ID included in the DISCOVERY\_REQUEST message was set to 0, and the 5G DDNMF shall allocate a new non-zero discovery entry ID for this entry.

Then the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <restricted-monitor-response> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message from the UE;

b) one or more restricted discovery filter(s) allocated by the 5G DDNMF(s) for the authorized target RPAUID(s);

c) the ACE enabled indicator set to "application-controlled extension enabled" if application-controlled extension is used, or "normal" if application-controlled extension is not used;

d) the discovery entry ID set to the ID of the discovery entry associated with this monitor request;

e) the application level container set to the application-level data received from the ProSe application server;

f) the coding-receiving security parameter containing the security-related information needed by the UE to undo the protection applied by the announcing UE;

g) the current time set to the current UTC-based time at the 5G DDNMF and the max offset; and

h) optionally, the PC5 security policies used for 5G ProSe direct link establishment procedure.

If T5067 expires, the 5G DDNMF shall remove the corresponding restricted discovery filter from the discovery entry in the UE's context. Furthermore, if there are no valid restricted discovery filters associated with the discovery entry (e.g., all restricted discovery filters have expired), the 5G DDNMF shall delete the discovery entry from the UE's context.

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

#### 6.2.5.5 Monitor request procedure not accepted by the 5G DDNMF

If the DISCOVERY\_REQUEST message is not accepted by the 5G DDNMF, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element to the UE including an appropriate PC3a control protocol cause value.

If the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is not authorized for ProSe direct discovery monitoring, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

If the RPAUID contained in the DISCOVERY\_REQUEST message is unknown to the ProSe application server, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #9 "Unknown RPAUID".

If none of the RPAUID(s) contained in the application level container in the DISCOVERY\_REQUEST message is eligible to be discovered by the requesting RPAUID, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #11 "Invalid discovery target".

If the RPAUID contained in the DISCOVERY\_REQUEST message does not match the stored RPAUID for the requested discovery entry ID, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #10 "Unknown or invalid discovery entry ID".

If the UE is not authorized for restricted 5G ProSe direct discovery monitoring, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorization failure".

If the RPAUID contained in the DISCOVERY\_REQUEST message is not associated with a PDUID belonging to the requesting UE, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorization failure".

If the UE is not authorized to use ACE, but the DISCOVERY\_REQUEST message contains the ACE enabled indicator set to "application-controlled extension enabled", the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #12 "UE unauthorized for discovery with application-controlled extension".

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF and the requested timer is set to 0, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #10 "Unknown or invalid discovery entry ID".

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

#### 6.2.6.2 Discoveree request procedure initiation

Before initiating the discoveree request procedure, the user sets the permissions for the restricted discovery using application layer mechanisms. The application client in the UE retrieves the PDUID provisioned to the UE as part of the service authorisation procedure as specified in clause 5 and obtains an RPAUID associated with the UE's PDUID from the ProSe application server. The UE can provide metadata to be associated with the RPAUID, and the ProSe application server stores the metadata. This step is performed using mechanisms that are out of scope of the present specification.

If the UE is authorised to perform restricted 5G ProSe direct discovery model B discoveree operation in the PLMN operating the radio resources signalled from the serving PLMN, it shall initiate a discoveree request procedure:

a) when the UE is triggered by an upper layer application to announce an RPAUID in Model B and the UE has no valid corresponding ProSe response code and discovery query filter(s) for that RPAUID of the upper layer application;

b) when the validity timer T5068 assigned by the 5G DDNMF to a ProSe response code and the corresponding discovery query filter(s) has expired and the request from upper layers to announce the RPAUID corresponding to that ProSe response code is still in place;

c) when the UE selects a new PLMN while announcing or waiting for announcing a ProSe response code and intends to announce in the new PLMN, and the UE is authorised for restricted 5G ProSe direct discovery model B discoveree operation in the new PLMN;

d) when, while announcing or waiting for announcing a ProSe response code, the UE intends to switch the announcing PLMN to a different PLMN without performing PLMN selection, and the UE does not have a valid allocated ProSe response code for this new PLMN yet; or

e) when the UE needs to update a previously sent restricted 5G ProSe direct discovery model B discoveree request.

When the UE selects a new PLMN while announcing or waiting for announcing a ProSe response code and the UE is not yet authorised for restricted 5G ProSe direct discovery model B discoveree operation in the new PLMN, the UE shall initiate a discoveree request procedure only after the UE is authorised for restricted 5G ProSe direct discovery model B discoveree operation in the new PLMN.

NOTE 1: To ensure service continuity if the UE needs to keep announcing in Model B a ProSe response code corresponding to the same RPAUID, the UE can initiate the discoveree request procedure before the validity timer T5068 assigned by the 5G DDNMF for a ProSe response code expires.

The UE shall initiate the discoveree request procedure by sending a DISCOVERY\_REQUEST message with:

a) a new transaction ID not used in any other direct discovery procedures in PC3a interface;

b) the RPAUID set to the RPAUID received from upper layers;

c) the command set to "response";

d) the UE identity set to the UE's SUPI;

e) the application identity set to the ProSe identifier of the upper layer application that requested the announcing as specified in clause 5.2.3;

f) the discovery type set to "Restricted discovery";

g) the discovery model set to "Model B";

h) the discovery entry ID set to a 0 if the discoveree request is a new request, and set to the discovery entry ID received from the 5G DDNMF if the discoveree request is to update a previously sent discoveree request; and

i) optionally the announcing PLMN ID set to the PLMN ID of the local PLMN operating the radio resources that the UE intends to use for announcing the RPAUID.

NOTE 2: A UE can include one or multiple transactions in one DISCOVERY\_REQUEST message for different RPAUIDs (e.g., for different applications), and receive corresponding <restricted-discoveree-response> element or <response-reject> element in a DISCOVERY\_RESPONSE message for each respective transaction. In the following description of the discoveree request procedure, only one transaction is included.

Figure 6.2.6.2.1 illustrates the interaction of the UE and the 5G DDNMF in the discoveree request procedure.



Figure 6.2.6.2.1: Discoveree request procedure for restricted 5G ProSe direct discovery model B

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

#### 6.2.6.3 Discoveree request procedure accepted by the 5G DDNMF

Upon receiving a DISCOVERY\_REQUEST message, the 5G DDNMF shall check that the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is authorised for restricted 5G ProSe direct discovery model B discoveree operation. If the application is authorised for restricted 5G ProSe direct discovery model B discoveree operation, the 5G DDNMF shall check whether there is an existing context for the UE.

If there is no associated UE context, the 5G DDNMF checks with the UDM whether the UE is authorised for restricted 5G ProSe direct discovery model B discoveree operation as described in 3GPP TS 29.503 [10]. If the check indicates that the UE is authorised, the 5G DDNMF creates a UE context that contains the UE's subscription parameters obtained from the UDM. The UDM also provides to the 5G DDNMF the PLMN ID of the PLMN in which the UE is currently registered.

If the UE context exists, the 5G DDNMF shall check whether the UE is authorized for restricted 5G ProSe direct discovery model B discoveree operation in the currently registered PLMN or the local PLMN identified by the Announcing PLMN ID included in the DISCOVERY\_REQUEST message.

If the UE is authorized and the discovery entry ID included in the DISCOVERY\_REQUEST message is set to 0 then:

a) the 5G DDNMF shall check whether the UE is authorised to announce the RPAUID contained in the DISCOVERY\_REQUEST message. Optionally this can include checking with the ProSe application server as described in 3GPP TS 29.557 [19] to obtain the binding between the RPAUID and PDUID, and then verifying that the PDUID belongs to the requesting UE;

b) if the UE is authorised to announce the RPAUID, the 5G DDNMF shall allocate the corresponding ProSe response code and ProSe query code for the RPAUID. It shall also allocate discovery query filter(s) based on the allocated ProSe query code. Then it shall assign a value for validity timer T5068, which is associated with the ProSe response code, ProSe query code and discovery query filter(s); and

c) the 5G DDNMF associates the allocated ProSe response code, ProSe query code, and discovery query filter with a new discovery entry ID in the UE context, and starts timer T5069. For a given ProSe response code, timer T5069 shall be longer than timer T5068. By default, the value of timer T5069 is 4 minutes greater than the value of timer T5068.

If the discovery entry ID included in the DISCOVERY\_REQUEST message is not set to 0 and if there is an existing discovery entry for this discovery entry ID value in the UE context, the 5G DDNMF shall either update the discovery entry with a new validity timer T5068, or allocate a new ProSe response code, ProSe query code and the discovery query filter(s) for the requested RPAUID with a new validity timer T5068, restart timer T5069.

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is not found in the UE context or there is no UE context in the 5G DDNMF, the 5G DDNMF shall behave as if the discovery entry ID included in the DISCOVERY\_REQUEST message was set to 0, and the 5G DDNMF shall allocate a new non-zero discovery entry ID for this entry.

If a new UE context was created or an existing UE context was updated, and the UE is currently roaming or the Announcing PLMN ID is included in the DISCOVERY\_REQUEST message, the 5G DDNMF checks with the 5G DDNMF of the VPLMN or the local PLMN identified by the Announcing PLMN ID whether the UE is authorised for restricted 5G ProSe direct discovery model B discoveree operation as described in 3GPP TS 29.555 [9].

The 5G DDNMF shall then send a DISCOVERY\_RESPONSE message containing a <restricted-discoveree-response> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message from the UE;

b) the ProSe response code set to the ProSe response code allocated for the RPAUID received in the DISCOVERY\_REQUEST message;

c) one or more discovery query filters set to the ProSe query filter(s) used to match a query for the RPAUID received in the DISCOVERY\_REQUEST message;

d) a validity timer T5068 set to the T5068 timer value assigned by the 5G DDNMF to the ProSe response code and the discovery query filter(s);

e) the code-sending security parameter containing the security-related information for the discoveree UE to protect the transmission of the ProSe response code;

f) the code-receiving security parameter containing the security-related information needed by the discoveree UE to undo the protection applied by the discoverer UE;

g) the discovery entry ID set to the ID of the discovery entry associated with this discoveree request in the UE context;

h) the current time set to the current UTC-based time at the 5G DDNMF and the max offset; and

i) optionally, the PC5 security policies used for 5G ProSe direct link establishment procedure.

If timer T5069 expires, the 5G DDNMF shall remove the discovery entry associated with the corresponding RPAUID from the UE's context.

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

#### 6.2.6.5 Discoveree request procedure not accepted by the 5G DDNMF

If the DISCOVERY\_REQUEST message cannot be accepted by the 5G DDNMF, the 5G DDNMF sends a DISCOVERY\_RESPONSE message containing a <response-reject> element to the UE including an appropriate PC3a control protocol cause value.

If the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is not authorised for ProSe direct discovery Model B discoveree operation, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

If the RPAUID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF or ProSe application server, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #9 "Unknown RPAUID".

If the RPAUID contained in the DISCOVERY\_REQUEST message does not match the stored RPAUID for the requested discovery entry ID, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #10 "Unknown or invalid discovery entry ID".

If the UE is not authorised for restricted 5G ProSe direct discovery model B discoveree operation, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorisation failure".

If the RPAUID contained in the DISCOVERY\_REQUEST message is not associated with a PDUID belonging to the requesting UE, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorisation failure".

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

#### 6.2.7.2 Discoverer request procedure initiation

Before initiating the discoverer request procedure, the user sets the permissions for the restricted discovery using application layer mechanisms. The application client in the UE retrieves the PDUID provisioned to the UE as part of the service authorisation procedure as specified in clause 5 and obtains an RPAUID associated with the UE's PDUID from the ProSe application server. The UE can also obtain the target RPAUID(s) from the ProSe application server. This step is performed using mechanisms that are out of scope of the present specification.

If the UE is authorised to perform restricted 5G ProSe direct discovery model B discoverer operation in the PLMN operating the radio resources signalled from the serving PLMN, it shall initiate a discoverer request procedure:

a) when the UE is triggered by an upper layer application to perform the query for one or more target RPAUIDs in Model B and the UE has no valid corresponding ProSe query code and Discovery Response Filter for those target RPAUIDs of the upper layer application;

b) when the validity timer T5070 assigned by the 5G DDNMF to a ProSe query codes and the corresponding Discovery Response Filter has expired and the request from upper layers to announce the RPAUID corresponding to that ProSe response code is still in place;

c) when the UE selects a new PLMN while announcing a ProSe query code or waiting for a ProSe response code and intends to announce the ProSe query code in the new PLMN, and the UE is authorised for restricted 5G ProSe direct discovery model B discoverer operation in the new PLMN;

d) when, while querying for target RPAUID(s), the UE intends to switch the announcing PLMN to a different PLMN without performing PLMN selection, and the UE does not have a valid allocated ProSe query code for this new PLMN yet; or

e) when the UE needs to update a previously sent restricted 5G ProSe direct discovery model B discoverer request.

When the UE selects a new PLMN while announcing a ProSe query code or waiting for a ProSe response code and the UE is not yet authorised for restricted 5G ProSe direct discovery model B discoverer operation in the new PLMN, the UE shall initiate a discoverer request procedure only after the UE is authorised for restricted 5G ProSe direct discovery model B discoverer operation in the new PLMN.

NOTE 1: To ensure service continuity if the UE needs to keep announcing in Model B a ProSe query code corresponding to the same RPAUID, the UE can initiate the discoverer request procedure before the validity timer T5070 assigned by the 5G DDNMF for a ProSe query code expires.

The UE shall initiate the discoverer request procedure by sending a DISCOVERY\_REQUEST message with:

a) a new transaction ID not used in any other direct discovery procedures in PC3a interface;

b) the RPAUID set to the RPAUID received from upper layers;

c) the application level container set to contain the application-layer information, e.g., target RPAUID(s) to discover;

d) the command set to "query";

e) the UE identity set to the UE's SUPI;

f) the application identity set to the ProSe identifier of the upper layer application that requested the announcing as specified in clause 5.2.3;

g) the discovery type set to "Restricted discovery";

h) the discovery model set to "Model B";

i) the discovery entry ID set to a 0 if the discoverer request is a new request, and set to the discovery entry ID received from the 5G DDNMF if the discoverer request is to update a previously sent discoverer request; and

j) optionally the Announcing PLMN ID set to the PLMN ID of the local PLMN operating the radio resources that the UE intends to use for transmitting the query for the target RPAUID(s).

NOTE 2: A UE can include one or multiple transactions in one DISCOVERY\_REQUEST message for different discovering requests (e.g., for different applications), and receive corresponding <restricted-discoverer-response> element or <response-reject> element in a DISCOVERY\_RESPONSE message for each respective transaction. In the following description of the discoverer request procedure, only one transaction is included.

Figure 6.2.7.2.1 illustrates the interaction of the UE and the 5G DDNMF in the discoverer request procedure.



Figure 6.2.7.2.1: Discoverer request procedure for restricted 5G ProSe direct discovery model B

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

#### 6.2.7.3 Discoverer request procedure accepted by the 5G DDNMF

Upon receiving a DISCOVERY\_REQUEST message, the 5G DDNMF shall check that the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is authorised for restricted 5G ProSe direct discovery model B discoverer operation. If the application is authorised for restricted 5G ProSe direct discovery model B discoverer operation, the 5G DDNMF shall check whether there is an existing context for the UE.

If there is no associated UE context, the 5G DDNMF checks with the UDM whether the UE is authorised for restricted 5G ProSe direct discovery model B discoverer operation as described in 3GPP TS 29.503 [10]. If the check indicates that the UE is authorised, the 5G DDNMF creates a UE context that contains the UE's subscription parameters obtained from the UDM. The UDM also provides to the 5G DDNMF the PLMN ID of the PLMN in which the UE is currently registered.

If the UE context exists, the 5G DDNMF shall check whether the UE is authorized for restricted 5G ProSe direct discovery model B discoveree operation in the currently registered PLMN or the local PLMN identified by the Announcing PLMN ID included in the DISCOVERY\_REQUEST message.

If the UE is authorized and the discovery entry ID included in the DISCOVERY\_REQUEST message is set to 0 then:

a) the 5G DDNMF uses the procedure described in 3GPP TS 29.557 [19] to pass the application level container included in the DISCOVERY\_REQUEST message to the ProSe application server and obtain a list of PDUID(s) corresponding to the authorised target RPAUID(s) from the ProSe application server;

b) for each of the PDUIDs corresponding to an authorised target RPAUID:

1) if the PLMN ID of the PDUID is not the same as that of the PLMN to which the 5G DDNMF belongs, then the 5G DDNMF executes the procedures defined in 3GPP TS 29.555 [9] to obtain the ProSe query code, the ProSe response code, the associated validity timer T5070, and optionally metadata associated with this target RPAUID. Otherwise, the 5G DDNMF shall locate the discoveree UE context and retrieve the corresponding ProSe query code and ProSe response code and the validity timer T5070, and optionally metadata associated with this RPAUID. Then, the 5G DDNMF in the HPLMN builds one or more discovery response filter(s) based on the respective ProSe response code, and associate the discovery response filter(s) and ProSe query code with a new validity timer T5071 based on the remaining value of T5071.

NOTE 1: If the 5G DDNMF cannot retrieve the corresponding discoveree UE context for a target RPAUID, e.g., the target RPAUID has not yet been requested to be discovered by Model B in a discoveree request procedure, or the discoveree UE context expires, the 5G DDNMF can skip the processing of this target RPAUID.

NOTE 2: The 5G DDNMF can choose the value of T5070 to be longer than the remaining value of T5069, so that the discoverer UE sends a new discoverer request for renewing the query-related information no earlier than the discoveree UE renewing its own ProSe response code with the 5G DDNMF.

2) the 5G DDNMF associates the ProSe query code and corresponding discovery response filter(s), target RPAUID, and optionally metadata associated with the target RPAUID with a new discovery entry in the discoverer UE's context; and

c) the 5G DDNMF starts timer T5071 assigned for each ProSe query code and discovery response filter(s) (of each target RPAUID) under this discovery entry of the discoverer UE context. For a given ProSe query code and the corresponding discovery response filter(s), timer T5071 shall be longer than timer T5070. By default, the value of timer T5071 is 4 minutes greater than the value of timer T5070.

If the discovery entry ID included in the DISCOVERY\_REQUEST message is not set to 0 and if there is an existing discovery entry for this discovery entry ID value in the UE's context, the 5G DDNMF shall still process the above steps, but update the discovery entry instead of creating a new discovery entry.

If the discovery entry ID contained in the DISCOVERY\_REQUEST message is not found in the UE context or there is no UE context in the 5G DDNMF, the 5G DDNMF shall behave as if the discovery entry ID included in the DISCOVERY\_REQUEST message was set to 0, and the 5G DDNMF shall allocate a new non-zero discovery entry ID for this entry.

If a new UE context was created or an existing UE context was updated, the UE is currently roaming or the announcing PLMN ID is included in the DISCOVERY\_REQUEST message, the 5G DDNMF checks with the 5G DDNMF of the VPLMN or the local PLMN indicated by the announcing PLMN ID whether the UE is authorised for restricted 5G ProSe direct discovery model B discoverer operation as described in 3GPP TS 29.555 [9].

The 5G DDNMF shall then send a DISCOVERY\_RESPONSE message containing a <restricted-discoverer-response> element with:

a) the transaction ID set to the value of the transaction ID received in the DISCOVERY\_REQUEST message from the UE;

b) one or more Subquery Result information elements, each of which includes:

1) a target RPAUID;

2) the ProSe query code set to the ProSe query code for the target RPAUID;

3) one or more discovery response filters which are set to the discovery response filter(s) used to match a potential ProSe response code responding to the ProSe query code;

4) a validity timer T5070 set to the T5070 timer value assigned by the 5G DDNMF to the ProSe query code and the discovery response filter(s);

5) optionally, the metadata associated with the target RPAUID;

6) the code-sending security parameter containing the security-related information needed by the discoverer UE to protect the transmission of ProSe query code; and

7) the code-receiving security parameter containing the security-related information needed by the discoverer UE to undo the protection applied by the discoveree UE;

c) the discovery entry ID set to the ID of the discovery entry associated with this announce request in the UE context;

d) the current time set to the current UTC-based time at the 5G DDNMF and the max offset; and

e) optionally, the PC5 security policies used for 5G ProSe direct link establishment procedure.

If T5071 expires, the 5G DDNMF shall remove the corresponding ProSe query code and ProSe response filter(s) from the discovery entry associated with the discoverer UE's context.

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

#### 6.2.7.5 Discoverer request procedure not accepted by the 5G DDNMF

If the DISCOVERY\_REQUEST message cannot be accepted by the 5G DDNMF, the 5G DDNMF sends a DISCOVERY\_RESPONSE message containing a <response-reject> element to the UE including an appropriate PC3a control protocol cause value.

If the application corresponding to the ProSe identifier contained in the DISCOVERY\_REQUEST message is not authorised for restricted 5G ProSe direct discovery Model B discoverer operation, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #1 "Invalid application".

If the RPAUID contained in the DISCOVERY\_REQUEST message is unknown to the 5G DDNMF or ProSe application server, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #9 "Unknown RPAUID".

If the RPAUID contained in the DISCOVERY\_REQUEST message does not match the stored RPAUID for the requested discovery entry ID, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #10 "Unknown or invalid discovery entry ID".

If the UE is not authorised for restricted 5G ProSe direct discovery model B discoverer operation, the 5G DDNMF shall send the DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorisation failure".

If the RPAUID contained in the DISCOVERY\_REQUEST message is not associated with a PDUID belonging to the requesting UE, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #3 "UE authorisation failure".

If the 5G DDNMF fails to retrieve any valid target PDUIDs from ProSe application server based on the application level container contained in the DISCOVERY\_REQUEST message, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #11 "Invalid discovery target".

If the 5G DDNMF fails to retrieve any valid discoveree UE contexts for the valid target RPAUIDs contained in the application level container contained in the DISCOVERY\_REQUEST message, the 5G DDNMF shall send a DISCOVERY\_RESPONSE message containing a <response-reject> element with PC3a control protocol cause value #11 "Invalid discovery target".

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

#### 6.2.9.2 Match report procedure initiation

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

a) a request from upper layers to monitor for the target RPAUID, which resulted in the matched ProSe restricted code, is still in place;

b) the lower layers have provided UTC time information, along with the discovery message containing the ProSe restricted code; and

c) the TTL timer T5066 associated with the Restricted discovery filter, whose use resulted in a match event of the ProSe restricted code, has not expired.

If the UE is authorized to perform restricted 5G ProSe direct discovery monitoring model A in the monitored PLMN, it should initiate a match report procedure:

a) when there is a match event after applying one of the Restricted discovery filter(s) to a ProSe restricted code received from the lower layers, and the UE does not have a corresponding RPAUID already locally stored;

b) when the UE has a locally stored mapping for the ProSe restricted code that resulted in a match event, but the validity timer T5076 of the ProSe restricted code has expired;

c) when the UE has a locally stored mapping for the ProSe restricted code that resulted in a match event, but the match report refresh timer T5077 of the ProSe restricted code has expired;

d) when the UE desires to obtain the metadata associated with the discovered ProSe restricted code; or

e) when the UE has a locally stored mapping for the ProSe restricted code that resulted in a match event, but the UE does not have a running match report refresh timer T5077 for this ProSe restricted code and the UE is directed by the 5G DDNMF to perform the required MIC check via the match report procedure.

NOTE 1: The 5G DDNMF directs the UE to use the match report procedure to perform the MIC check by including the MIC Check Indicator parameter in the DISCOVERY\_RESPONSE message.

The UE initiates the match report procedure by sending a MATCH\_REPORT message with a new transaction ID and shall set the message contents as follows:

a) the RPAUID set to the UE's RPAUID which has requested the corresponding monitoring operation that resulted this match event;

b) the ProSe restricted code set to the ProSe restricted code for which there was a match event;

c) the UE identity set to the UE's SUPI;

d) the discovery type set to "Restricted discovery";

e) the application identity set to the ProSe identifier of the upper layer application that triggered the monitoring operation as specified in clause 5.2.3;

f) optionally, the UTC-based counter set as follows if the MIC is checked via the match report procedure:

1) the UE shall generate two UTC-based counters with:

i) the first counter composed of:

A) the 23 most significant bits of the UTC-based counter set to the 23 most significant bits of the UTC time provided by the lower layers for the PROSE PC5 DISCOVERY message that contained the ProSe restricted code for which there was a match event encoded as specified in clause 11.2.2.18;

B) the 24th most significant bit of the UTC-based counter set to '0'; and

C) the 8 least significant bits of the UTC-based counter set to the 8 least significant bits of the UTC-based counter contained in the PROSE PC5 DISCOVERY message that contained the ProSe restricted code for which there was a match event, as specified in 3GPP TS 33.503 [34]; and

ii) the second counter composed of:

A) the 23 most significant bits of the UTC-based counter set to the 23 most significant bits of the UTC time provided by the lower layers for the PROSE PC5 DISCOVERY message that contained the ProSe restricted code for which there was a match event encoded as specified in clause 11.2.2.18;

B) the 24th most significant bit of the UTC-based counter set to '1'; and

C) the 8 least significant bits of the UTC-based counter set to the 8 least significant bits of the UTC-based counter contained in the PROSE PC5 DISCOVERY message that contained the ProSe restricted code for which there was a match event, as specified in 3GPP TS 33.503 [34]; and

Editor's Note: Security aspect will be updated upon SA3 normative requirement is available.

2) then the UE shall select, among the two counters described above, the counter that is nearest to the UTC time provided by the lower layers for the PROSE PC5 DISCOVERY message that contained the ProSe restricted code for which there was a match event encoded as specified in clause 11.2.2.18, and set the UTC-based counter in the MATCH\_REPORT message to that counter;

g) optionally, the message type set to the value of message type field of the PROSE PC5 DISCOVERY message that contained the ProSe restricted code for which there was a match event, if the MIC is checked via the match report procedure;

h) optionally, the MIC set to the MIC of the PROSE PC5 DISCOVERY message that contained the ProSe restricted code for which there was a match event if the MIC is checked via the match report procedure; and

i) the metadata flag set to indicate whether or not the UE wishes to receive the latest metadata information associated with the RPAUID in the MATCH\_REPORT\_ACK message from the 5G DDNMF.

NOTE 2: A UE can include one or multiple transactions in one MATCH\_REPORT message for different ProSe restricted codes, and receive a corresponding <restricted-match-ack> element or <match-reject> element in the MATCH\_REPORT\_ACK message for each respective transaction. In the following description of match report procedure, only one transaction is included.

Figure 6.2.9.2.1 illustrates the interaction between the UE and the 5G DDNMF in the match report procedure.



Figure 6.2.9.2.1: Match report procedure for restricted discovery model A

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

#### 6.2.9.3 Match report procedure accepted by the 5G DDNMF

Upon receiving a MATCH\_REPORT message, the 5G DDNMF shall check whether there is an existing context for the UE identified by its SUPI.

The 5G DDNMF shall analyze the ProSe restricted code received from the UE in the MATCH\_REPORT message. If the MIC value and its corresponding UTC-based counter are included, the 5G DDNMF shall check whether the MIC value and the UTC-based counter are valid and within the acceptable range respectively as defined in 3GPP TS 33.503 [34]. The 5G DDNMF shall then check in the UE context if the ProSe restricted code matches any restricted discovery filter(s) allocated for the particular application identified by the ProSe identifier received in the MATCH\_REPORT message. If such a discovery filter exists, the target RPAUID associated with the filter(s) shall be identified as the corresponding RPAUID for this code. Optionally, the 5G DDNMF may further invoke the procedure defined in 3GPP TS 29.503 [10] to verify if the target RPAUID is allowed to be discovered by the RPAUID of the requesting UE that has sent the MATCH\_REPORT message, or to retrieve metadata associated for the target RPAUID if metadata flag is set to "True" in the MATCH\_REPORT message and the 5G DDNMF does not have the latest metadata.

If the outcome of the above processing is successful, the 5G DDNMF shall send a MATCH\_REPORT\_ACK message containing a <restricted-match-ack> element with:

a) the transaction ID set to the value of the transaction ID received in the MATCH\_REPORT message from the UE;

b) the RPAUID set to the target RPAUID retrieved from the UE context at the 5G DDNMF which corresponds to the ProSe restricted code contained in the MATCH\_REPORT message;

c) the validity timer T5076 set to indicate for how long this ProSe restricted code is valid;

d) the match report refresh timer T5077 to indicate for how long the UE will wait before sending a new match report for this ProSe restricted code if the MIC value and the UTC-based counter are included in the MATCH\_REPORT message; and

e) the metadata set to the associated metadata information, if there exists metadata information associated with this target RPAUID and the metadata flag is set to "True" in the MATCH\_REPORT message.

If the corresponding PDUID of the target RPAUID does not belong to the HPLMN of the requesting UE, the 5G DDNMF may optionally invoke the procedure defined in 3GPP TS 29.555 [9] to inform the 5G DDNMF of the announcing UE about the match event.

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

#### 6.2.10.2 Match report procedure initiation

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

a) a request from upper layers to discover the target RPAUID with restricted discovery model B, which resulted in the matched ProSe response code, is still in place;

b) the lower layers have provided UTC time information, along with the discovery message containing the ProSe response code; and

c) the validity timer T5070 associated with the discovery response filter, whose use resulted in a match event of the ProSe response code, has not expired.

If the UE is authorized to perform restricted 5G ProSe direct discovery model B discoverer operation in the monitored PLMN, it should initiate a match report procedure:

a) when there is a match event when applying one of the discovery response filter(s) to one of the ProSe response codes received from the lower layers, and the UE does not have a corresponding RPAUID already locally stored;

b) when the UE has a locally stored mapping for the ProSe response code that resulted in a match event, but the validity timer T5076 of the ProSe response code has expired;

c) when the UE has a locally stored mapping for the ProSe response code that resulted in a match event, but the match report refresh timer T5077 of the ProSe response code has expired;

d) when the UE desires to obtain the metadata associated with the discovered ProSe response code; or

e) when the UE has a locally stored mapping for the ProSe response code that resulted in a match event, but the UE does not have a running match report refresh timer T5077 for this ProSe response code and the UE is directed by the 5G DDNMF to perform the required MIC check via the match report procedure.

NOTE 1: The 5G DDNMF directs the UE to use the match report procedure to perform the MIC check by including the MIC Check Indicator parameter in the DISCOVERY\_RESPONSE message.

The UE initiates the match report procedure by sending a MATCH\_REPORT message with a new transaction ID and shall set the message contents as follows:

a) the RPAUID set to the UE's RPAUID which has requested the corresponding restricted discovery model B discoverer operation that resulted this match event;

b) the ProSe response code set to the ProSe response code for which there was a match event;

c) the UE identity set to the UE's SUPI;

d) the discovery type set to "Restricted discovery";

e) the application identity set to the ProSe identifier of the upper layer application that triggered the restricted direct discovery Model B discoverer operation as described in clause 5.2.3;

f) optionally, the UTC-based counter set as follows if the MIC is checked via the match report procedure:

1) the UE shall generate two UTC-based counters with:

i) the first counter composed of:

A) the 27 most significant bits of the UTC-based counter set to the 27 most significant bits of the UTC time provided by the lower layers for the PROSE PC5 DISCOVERY message that contained the ProSe response code for which there was a match event encoded as specified in clause 11.2.2.18;

B) the 24th most significant bit of the UTC-based counter set to '0'; and

C) the 8 least significant bits of the UTC-based counter shall be set to the 8 least significant bits of the UTC-based counter contained in the PROSE PC5 DISCOVERY message that contained the ProSe response code for which there was a match event, as specified in 3GPP TS 33.503 [34]; and

ii) the second counter composed of:

A) the 23 most significant bits of the UTC-based counter set to the 23 most significant bits of the UTC time provided by the lower layers for the PROSE PC5 DISCOVERY message that contained the ProSe response code for which there was a match event encoded as specified in clause 11.2.2.18;

B) the 24th most significant bit of the UTC-based counter set to '1'; and

C) the 8 least significant bits of the UTC-based counter set to the 8 least significant bits of the UTC-based counter contained in the PROSE PC5 DISCOVERY message that contained the ProSe response code for which there was a match event, as specified in 3GPP TS 33.503 [34]; and

2) then the UE shall select, among the two counters described above, the counter that is nearest to the UTC time provided by the lower layers for the PROSE PC5 DISCOVERY message that contained the ProSe response code for which there was a match event encoded as specified in clause 11.2.2.18, and set the UTC-based counter in the MATCH\_REPORT message to that counter;

g) optionally, the message type set to the value of message type field of the PROSE PC5 DISCOVERY message that contained the ProSe response code for which there was a match event, if the MIC is checked via the match report procedure;

h) optionally, the MIC to the MIC of the PROSE PC5 DISCOVERY message that contained the ProSe response code for which there was a match event if the MIC is checked via the match report procedure; and

i) the metadata flag set to indicate whether or not the UE wishes to receive the latest metadata information associated with the RPAUID in the MATCH\_REPORT\_ACK message from the 5G DDNMF.

NOTE 2: A UE can include one or multiple transactions in one MATCH\_REPORT message for different ProSe response codes, and receive corresponding <restricted-match-ack> element or <match-reject> element in the MATCH\_REPORT\_ACK message for each respective transaction. In the following description of match report procedure, only one transaction is included.

Figure 6.2.10.2.1 illustrates the interaction between the UE and the 5G DDNMF in the match report procedure.



Figure 6.2.10.2.1: Match report procedure for restricted discovery model B

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

#### 6.2.10.3 Match report procedure accepted by the 5G DDNMF

Upon receiving a MATCH\_REPORT message, the 5G DDNMF shall check whether there is an existing discoverer UE context for the UE identified by its SUPI.

The 5G DDNMF shall analyze the ProSe response code received from the UE in the MATCH\_REPORT message. If the MIC value and its corresponding UTC-based counter are included, the 5G DDNMF shall check whether the MIC value and the UTC-based counter are valid and within the acceptable range respectively, as defined in 3GPP TS 33.503 [34]. The 5G DDNMF shall then check in the UE context if the ProSe response code matches any discovery response filter(s) allocated for the particular application identified by the ProSe identifier received in the MATCH\_REPORT message. If such a discovery filter exists, the target RPAUID associated with the filter(s) shall be identified as the corresponding RPAUID for this code. Optionally, the 5G DDNMF may further invoke the procedure defined in 3GPP TS 29.503 [10] to verify if the target RPAUID is allowed to be discovered by the RPAUID of the requesting UE that has sent the MATCH\_REPORT message, or to retrieve metadata associated for the target RPAUID if metadata flag is set to "True" in the MATCH\_REPORT message and the 5G DDNMF does not have the latest metadata.

If the outcome of the above processing is successful, the 5G DDNMF shall send a MATCH\_REPORT\_ACK message containing a <restricted-match-ack> element with:

a) the transaction ID set to the value of the transaction ID received in the MATCH\_REPORT message from the UE;

b) the RPAUID set to the target RPAUID retrieved from the UE context at the 5G DDNMF which corresponds to the ProSe response code contained in the MATCH\_REPORT message;

c) the validity timer T5076 set to indicate for how long the RPAUID is matched;

d) the match report refresh timer T5077 set to indicate for how long the UE will wait before sending a new match report for this ProSe response code if the MIC value and the UTC-based counter are included in the MATCH\_REPORT message; and

e) optionally, the metadata set to the associated metadata information, if there exists metadata information associated with this target RPAUID.

If the corresponding PDUID of the target RPAUID does not belong to the HPLMN of the requesting UE, the 5G DDNMF may optionally invoke the procedure defined in 3GPP TS 29.555 [9] to inform the 5G DDNMF of the discoveree UE about the match event.

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

#### 6.2.13.3 Announcing alert procedure accepted by the UE

Upon receipt of the ANNOUNCING\_ALERT\_REQUEST message, the UE shall check if the UE identity contained in the ANNOUNCING\_ALERT\_REQUEST message is the SUPI of the UE. If the UE identity is the SUPI of the UE, the UE shall check whether there is an existing discovery entry identified by the discovery entry ID included in the ANNOUNCING\_ALERT\_REQUEST message. If the discovery entry exists in the UE, the UE shall send an ANNOUNCE\_ALERT\_RESPONSE message to the 5G DDNMF with a DDNMF transaction ID set to the value of the DDNMF transaction ID received in the ANNOUNCING\_ALERT\_REQUEST message.

Then, the UE may perform restricted 5G ProSe direct discovery model A announcing as described below.

The UE requests the parameters from the lower layers for restricted 5G ProSe direct discovery model A announcing (see 3GPP TS 38.331 [13]). The UE shall perform restricted 5G ProSe direct discovery model A announcing only if the lower layers indicate that ProSe direct discovery is supported by the network. If the UE in 5GMM-IDLE mode has to request resources for ProSe direct discovery announcing as specified in 3GPP TS 38.331 [13], the UE shall perform a service request procedure or registration procedure as specified in 3GPP TS 24.501 [11]. The UE shall obtain the UTC time for the next discovery transmission opportunity for ProSe direct discovery from the lower layers.

If a valid UTC time is obtained, the UE shall generate the UTC-based counter corresponding to this UTC time as specified in clause 11.2.2.18. If the resulting UTC-based counter is within Max Offset of the time shown by the clock used for ProSe by the UE, the UE shall use the UTC-based counter and the DUIK contained in the <restricted-announce-response> element of the DISCOVERY\_RESPONSE message to compute the MIC field for the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.503 [34].

The UE shall either use the ProSe restricted code received in the ANNOUNCING\_ALERT\_REQUEST message, or select one ProSe restricted code based on the ProSe restricted code prefix and ProSe restricted code suffix Range(s) received in the ANNOUNCING\_ALERT\_REQUEST message as announced ProSe restricted code, along with the MIC and the eight least significant bits of the UTC-based counter, in order to construct a PROSE PC5 DISCOVERY message, according to the format defined in clause 10.2.5.

NOTE: The UE can use different codes formed based on different ProSe restricted code suffixes to announce, without having to send a new DISCOVERY\_REQUEST message to the 5G DDNMF, as long as the validity timer T5062 of the ProSe restricted code prefix has not expired.

The UE then passes the PROSE PC5 DISCOVERY message to the lower layers for transmission if:

a) the UE is currently authorized to perform restricted 5G ProSe direct discovery model A announcing in the registered PLMN or the local PLMN operating the radio resources that the UE intends to use;

b) the validity timer T5062 for the corresponding discovery entry allocated ProSe restricted code or ProSe restricted code prefix has not expired; and

c) a request from upper layers to announce the RPAUID associated with both the ProSe restricted code or ProSe restricted code prefix, and the authorized ProSe identifier, is still in place.

The UE shall ensure that it keeps on passing PROSE PC5 DISCOVERY messages to the lower layers for transmission until the validity timer T5062 of the ProSe restricted code or ProSe restricted code prefix expires. How this is achieved is left up to UE implementation.

During the announcing operation, if one of the above conditions is no longer met, the UE may instruct the lower layers to stop announcing. When the UE stops announcing, if the lower layers indicate that the UE is required to send a discovery indication to the NG-RAN and the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [13].

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

###### 6.2.14.2.2.2 Discoverer UE procedure for 5G ProSe direct discovery initiation

The UE is authorised to perform the discoverer UE procedure for 5G ProSe direct discovery if:

a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery discoverer operation 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;

b) the UE is served by NG-RAN, and is authorised to perform 5G ProSe direct discovery discoverer operation in the PLMN indicated by the serving cell; or

c) the UE is:

1) 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:

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]; and

2) authorised to perform 5G ProSe direct discovery discoverer operation when the UE is not served by NG-RAN, and:

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

ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure.

NOTE: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

otherwise, the UE is not authorised to perform the discoverer UE procedure for 5G ProSe direct discovery.

Figure 6.2.14.2.2.2.1 illustrates the interaction of the UEs in the discoverer UE procedure for 5G ProSe direct discovery.



Figure 6.2.14.2.2.2.1: Discoverer UE procedure for 5G ProSe direct discovery

When the UE is triggered by an upper layer application to query the target RPAUID in restricted discovery Model B, associated with both the ProSe query code, and the authorised ProSe identifier, and

a) if the UE is authorised to perform the discoverer UE procedure for 5G ProSe direct discovery in the registered PLMN or the local PLMN operating the radio resources that the UE intends to use; and

b) if the validity timer T5070 for the ProSe query code and corresponding ProSe Response Filter(s) has not expired,

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];

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, and if the resulting UTC-based counter is within max offset of the time shown by the clock used for ProSe by the UE, the UE shall for each ProSe query code in this discovery entry, use the ProSe query code to construct a PROSE PC5 DISCOVERY message as below;

c) shall generate a PROSE PC5 DISCOVERY message for 5G ProSe direct discovery solicitation. In the PROSE PC5 DISCOVERY message for 5G ProSe direct discovery solicitation, the UE:

1) shall set the ProSe direct discovery PC5 message type parameter as specified in table 10.2.1.3;

2) shall include ProSe query code;

3) shall include the MIC filed computed as described in 3GPP TS 33.503 [34] by using the UTC-based counter and the discovery key contained in the <response-announce> element of the DISCOVERY\_RESPONSE message; and

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

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]; and

e) shall pass the resulting PROSE PC5 DISCOVERY message along with the source layer-2 ID and destination layer-2 ID for 5G ProSe direct discovery solicitation and the PLMN ID of the intended announcing PLMN if available in the discovery entry and an indication that the message is for 5G ProSe direct discovery to the lower layers for transmission over the PC5 interface, and shall instruct the lower layer to start monitoring.

The UE shall ensure that it keeps on passing the same PROSE PC5 DISCOVERY message to the lower layers for transmission until the validity timer T5070 of the ProSe query code expires. How this is achieved is left up to UE implementation.

The UE may apply the discovery response filter(s) received from the 5G DDNMF to its monitoring operation. Using the discovery response filter may result in a match event for the target RPAUID the UE is querying for. There is match event when, for any of the masks in a discovery response filter, the output of a bitwise AND operation between the ProSe response code contained in the received PROSE PC5 DISCOVERY message and the mask, matches the output of a bitwise AND operation between the mask and the code contained in the discovery response filter.

Upon reception of a PROSE PC5 DISCOVERY message for direct discovery response, for the target destination layer-2 ID of the direct discovery to be discovered, the UE shall use the associated DUSK, if configured as a part of the discovery response filter, and the UTC-based counter obtained during the monitoring operation to unscramble the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.303 [36]. 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 33.303 [36]. Finally, if a DUIK is configured, the UE shall use the DUIK and UTC-based counter to verify the MIC field in the unscrambled PROSE PC5 DISCOVERY message for direct discovery response. If a MIC Check Indicator parameter is included instead, the UE shall use the match report procedure described in clause 6.2.10 to trigger checking of the MIC of the PROSE PC5 DISCOVERY message containing the ProSe response code by the 5G DDNMF.

The UE may notify the upper layer application about the match event of restricted 5G ProSe direct discovery model B with the corresponding target RPAUID and metadata, if the RPAUID and metadata are included in the Subquery result element in the DISCOVERY\_RESPONSE message from the 5G DDNMF.

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.

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

###### 6.2.14.2.2.3 Discoverer UE procedure for 5G ProSe direct discovery completion

During the discoverer operation, if

a) the validity timer T5070 for the ProSe query code and corresponding ProSe Response Filter(s) has expired; and

b) the request from upper layers to query the target RPAUID in restricted discovery Model B, associated with both the ProSe query code, and the authorised ProSe identifier, is not in place, then

the UE may instruct the lower layers to stop the discoverer operation. When the UE stops discoverer operation, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [13].

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

###### 6.2.14.2.2.4 Discoveree UE procedure for 5G ProSe direct discovery initiation

The UE is authorised to perform the discoveree UE procedure for 5G ProSe direct discovery if:

a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery discoveree operation 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;

b) the UE is served by NG-RAN, and is authorised to perform 5G ProSe direct discovery discoverer operation in the PLMN indicated by the serving cell; or

c) the UE is:

1) 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:

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]; and

2) authorised to perform 5G ProSe direct discovery discoverer operation when the UE is not served by NG-RAN, and:

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

ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure.

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

otherwise, the UE is not authorised to perform the discoveree UE procedure for 5G ProSe direct discovery.

Figure 6.2.14.2.2.4.1 illustrates the interaction of the UEs in the discoveree UE procedure for 5G ProSe direct discovery.



Figure 6.2.14.2.2.4.1: Discoveree UE procedure for 5G ProSe direct discovery

When the UE is triggered by an upper layer application to perform discoveree operation for the RPAUID associated with an authorized ProSe identifier, and if:

a) the UE is authorised to perform the discoveree UE procedure for 5G ProSe direct discovery;

b) the UE has obtained the ProSe response code and discovery query filter(s) and the respective validity timer T5068 for the corresponding discovery entry has not expired; and

c) the difference between UTC-based counter associated with that discovery slot and UE's ProSe clock is not greater than the max offset of the monitoring UE's ProSe clock,

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 or registration procedure as specified in 3GPP TS 24.501 [11]; and

b) shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [13].

The UE may apply the discovery query filter(s) received from the 5G DDNMF to its monitoring operation. Using the discovery query filter(s) may result in a match event. There is match event when, for any of the masks in a discovery query filter, the output of a bitwise AND operation between the ProSe query code contained in the received PROSE PC5 DISCOVERY message and the mask, matches the output of a bitwise AND operation between the mask and the code contained in the discovery query filter.

Upon reception of a PROSE PC5 DISCOVERY message for direct discovery solicitation for the destination layer-2 ID which the UE is configured to respond for, with applying a discovery query filter to a received PROSE PC5 DISCOVERY message for the above-mentioned bitwise AND operation, the UE shall use the associated DUSK, if configured in the part of the discovery query filter, 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 configured in the part of the discovery query filter, 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 in the part of the discovery query filter, the UE shall use the DUIK and UTC-based counter to verify the MIC field in the unscrambled PROSE PC5 DISCOVERY message for direct discovery solicitation.

NOTE 2: The UE can look for a match on the unencrypted bits first before applying DUCK, to minimise the amount of processing performed before finding a match.

NOTE 3: The UE needs to verify the MIC field because the match report procedure is not used for checking the MIC of a PROSE PC5 DISCOVERY message containing a ProSe query code by the 5G DDNMF.

NOTE 4: The UE can determine the received PROSE PC5 DISCOVERY message for direct discovery solicitation is for 5G ProSe direct discovery based on an indication from the lower layer.

Once the match of the discovery query filter(s) occurs, the UE process this match event and requests the lower layers to announce the corresponding ProSe response code in the PC5 interface as a response, as specified in 3GPP TS 38.331 [13]. If the UE in 5GMM-IDLE mode has to request resources for 5G ProSe direct discovery announcing as specified in 3GPP TS 38.331 [13], the UE shall perform a service request procedure or registration procedure as specified in 3GPP TS 24.501 [11]. The UE 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. If the resulting UTC-based counter is within max offset of the time shown by the clock used for ProSe by the UE, the UE shall use the ProSe response code received in the DISCOVERY\_RESPONSE message from the 5G DDNMF. The UE shall generate a PROSE PC5 DISCOVERY message for 5G ProSe direct discovery response. In the PROSE PC5 DISCOVERY message for 5G ProSe direct discovery response, the UE:

a) shall set the ProSe direct discovery PC5 message type parameter as specified in table 10.2.1.4;

b) shall include ProSe response code;

c) shall include the MIC filed computed as described in 3GPP TS 33.503 [34] by using the UTC-based counter and the discovery key contained in the <response-announce> element of the DISCOVERY\_RESPONSE message;

d) may include the Metadata IE to provide the application layer metadata information; and

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

After generating the PROSE PC5 DISCOVERY message for 5G ProSe direct discovery response, the UE:

a) shall set the destination layer-2 ID to the source layer-2 ID of the received message;

b) 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]; and

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

For each match event with the discovery query filter(s), the UE shall at least pass PROSE PC5 DISCOVERY message once to the lower layers for transmission. The UE shall ensure that it keeps on passing PROSE PC5 DISCOVERY messages to the lower layers for transmission as response(s) to the match event(s) of the corresponding discovery query filter(s) until the validity timer T5068 expires. How this is achieved is left up to UE implementation.

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

###### 6.2.14.2.2.5 Discoveree UE procedure for 5G ProSe direct discovery completion

During the discoveree operation, if

a) the validity timer T5068 for the ProSe response code and corresponding discovery query filter(s) has expired; and

b) the request from upper layers to perform discoveree operation for the RPAUID associated with an authorized ProSe identifier is not in place, then

the UE may instruct the lower layers to stop monitoring.

When the UE stops monitoring, if the lower layers indicate that the UE is required to send a discovery indication to the NG-RAN and the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [13].

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

#### 11.4.2.5 Application identity

This parameter is used to identify the particular application that triggers the DISCOVERY\_REQUEST message. The Application identity information element is coded as the ProSe identifier specified in clause 11.3.3.

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