**3GPP TSG-CT WG1 Meeting #141eC1-232144**

**Online 17– 21 April 2023**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Pseudo-CR on** **A2X communication over PC5 and A2X PC5 unicast link establishment procedure**

**Spec: 3GPP TS 24.577 v0.0.0**

**Agenda item: 18.2.21**

**Document for: Approval**

**1. Introduction**

This p-CR provides content of A2X communication over PC5 (clause 6.1), of A2X PC5 unicast link establishment procedure (clause 6.1.2.2) and of clause 6.1.2.1 in 3GPP TS 24.577 specification related to the UAS\_Ph2 work item.

**2. Reason for Change**

A2X communication (Section 6) in 3GPP TS 24.577 specification needs to be defined based on SA2 requirements in clause 4.2.1.2.1 and clause 5.4.4 in 3GPP TS 23.256.

**3. Proposal**

It is proposed to agree the following changes to 3GPP TS 24.577 v0.0.0.

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

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[A] 3GPP TS 23.256: " Support of Uncrewed Aerial Systems (UAS) connectivity, identification and tracking; Stage 2 ".

[B] 3GPP TS 24.501: "Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[C] 3GPP TS 24.578: "Aircraft-to-Everything (A2X) services in 5G System (5GS); UE policies".

[D] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services); Stage 2".

[E] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[F] 3GPP TS 24.587: "Vehicle-to-Everything (V2X) services in 5G System (5GS); Protocol aspects; Stage 3”.

[G] 3GPP TS 23.285: "Architecture enhancements for V2X services".

[H] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".

[I] 3GPP TS 38.304: "User Equipment (UE) procedures in Idle mode and RRC Inactive state".

[J] 3GPP TS 33.256: "Security aspects of Uncrewed Aerial Systems (UAS)".

[K] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage 2".

[L] IETF RFC 4862: "Neighbor Discovery for IP version 6 (IPv6)".

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

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

Abbreviation format (EW)

<ABBREVIATION> <Expansion>

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.256 [A] apply:

**A2X**

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

# 6 A2X communication

This clause describes the procedures at the UE, and between UEs, for A2X communication over PC5. As specified in 3GPP TS 23.256 [A] clause 4.2.1.2.1, both LTE-PC5 and NR-PC5 are supported leveraging V2X mechanisms defined in TS 23.287 [F].

## 6.1 A2X communication over PC5

### 6.1.1 General

This clause describes the procedures at the UE, and between UEs, for A2X communication over PC5.

The UE shall support requirements for securing A2X communication over PC5.

Both IP based and non-IP based A2X communication over PC5 are supported. For IP based A2X communication, only IPv6 is used. IPv4 is not supported in this release of the present document.

A2X communication over NR-PC5 supports broadcast mode and unicast mode. Groupcast mode for A2X communication over NR-PC5 is not supported in this version of the specifications. If upper layer of the UE indicates the mode of communication, the UE shall set the mode of communication based on the request of the upper layer. Otherwise, the UE shall set the mode of communication based on the mapping rules between the A2X service identifier and the default mode of communication defined in clause 5.2.3.

Editor's note (pCR , UAS\_Ph2): Unicast mode adaptation for A2X is FFS based on RAN conclusions when available.

A2X communication over LTE-PC5 in EPS uses only the autonomous resources selection mode. The network scheduled operation mode is not supported for A2X as specified in TS 23.256 [A] clause 4.2.1.2.1.

### 6.1.2 Unicast mode A2X communication over NR-PC5

#### 6.1.2.1 Overview

This clause describes the PC5 signalling protocol procedures between two UEs for unicast mode of A2X communication. The following PC5 signalling protocol procedures are defined:

a) A2X PC5 unicast link establishment;

b) A2X PC5 unicast link modification;

c) A2X PC5 unicast link release;

d) A2X PC5 unicast link identifier update;

e) A2X PC5 unicast link authentication;

f) A2X PC5 unicast link keep-alive; and

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

#### 6.1.2.2 A2X PC5 unicast link establishment procedure

##### 6.1.2.2.1 General

Depending on the type of the A2X PC5 unicast link establishment procedure (i.e. UE oriented Layer-2 link establishment or Service oriented Layer-2 link establishment in 3GPP TS 23.287[D]), the A2X PC5 unicast link establishment procedure is used to establish an A2X PC5 unicast link between two UEs or to establish multiple A2X PC5 unicast links. The UE sending the request message is called the "initiating UE" and the other UE is called the "target UE". If the request message does not indicate the specific target UE (i.e. target user info is not included in the request message), and multiple target UEs are interested in the A2X service(s) indicated in the request message, then the initiating UE shall handle corresponding response messages received from those target UEs. The maximum number of A2X NR-PC5 unicast links established in a UE at a time shall not exceed an implementation-specific maximum number of established A2X NR-PC5 unicast links.

NOTE: The recommended maximum number of established A2X NR-PC5 unicasts link is 8.

##### 6.1.2.2.2 A2X PC5 unicast link establishment procedure initiation by initiating UE

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

a) a request from upper layers to transmit the packet for A2X service over PC5;

b) the communication mode is unicast mode (e.g. pre-configured as specified in clause 5.2.3 or indicated by upper layers);

c) the link layer identifier for the initiating UE (i.e. layer-2 ID used for unicast communication) is available (e.g. pre-configured or self-assigned) and is not being used by other existing A2X PC5 unicast links to the same link layer identifier for the destination UE within the initiating UE;

d) the link layer identifier for the destination UE (i.e. the unicast layer-2 ID of the target UE or the broadcast layer-2 ID) is available to the initiating UE (e.g. pre-configured, obtained as specified in clause 5.2.3 or known via prior A2X communication);

NOTE 1: In the case where different A2X services are mapped to distinct default destination layer-2 IDs, when the initiating UE intends to establish a single unicast link that can be used for more than one A2X service identifiers, the UE can select any of the default destination layer-2 ID for unicast initial signalling.

e) the initiating UE is either authorised for A2X communication over PC5 in NR-PC5 in the serving PLMN, or has a valid authorization for A2X communication over PC5 in NR-PC5 when not served by E-UTRA and not served by NR. The UE considers that it is not served by E-UTRA and not served by NR if the following conditions are met:

1) not served by NR and not served by E-UTRA for A2X communication over PC5;

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

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

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 [B]; 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 [B]; or

3) in limited service state as specified in 3GPP TS 23.122 [H] for reasons other than i), ii) or iii) above, and located in an altitude range and a geographical area for which the UE is provisioned with "non-operator managed" radio parameters as specified in clause 5.2.3;

f) there is no existing A2X PC5 unicast link for the pair of peer application layer IDs, or there is an existing A2X PC5 unicast link for the pair of peer application layer IDs and:

1) the network layer protocol of the existing A2X PC5 unicast link is not identical to the network layer protocol required by the upper layer in the initiating UE for this A2X service; or

2) the security policy (either signalling security policy or user plane security policy) corresponding to the A2X service identifier is not compatible with the security policy of the existing A2X PC5 unicast link; and

g) the number of established A2X PC5 unicast links is less than the implementation-specific maximum number of established A2X NR-PC5 unicast links allowed in the UE at a time.

After receiving the service data or request from the upper layers, the initiating UE shall derive the PC5 QoS parameters and assign the PQFI(s) for the PC5 QoS flows(s) to be established as specified in clause 6.1.2.12.

In order to initiate the A2X PC5 unicast link establishment procedure, the initiating UE shall create an A2X DIRECT LINK ESTABLISHMENT REQUEST message. The initiating UE:

a) shall include the source user info set to the initiating UE's application layer ID received from upper layers;

b) shall include the A2X service identifier(s) received from upper layer;

c) shall include the target user info set to the target UE's application layer ID if received from upper layers or if the destination layer-2 ID is the unicast layer-2 ID of target UE;

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

NOTE 2: The Key establishment information container is provided by upper layers.

e) shall include a Nonce\_1 set to the 128-bit nonce value generated by the initiating UE for the purpose of session key establishment over this A2X PC5 unicast link if the UE PC5 unicast signalling integrity protection policy is set to "signalling integrity protection required" or "signalling integrity protection preferred";

f) shall include its UE security capabilities indicating the list of algorithms that the initiating UE supports for the security establishment of this A2X PC5 unicast link;

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

g) shall include its UE PC5 unicast signalling security policy. In the case where the different A2X services are mapped to the different PC5 unicast signalling security policies, when the initiating UE intends to establish a single unicast link that can be used for more than one A2X service, each of the signalling security polices of those A2X services shall be compatible, e.g. "signalling integrity protection not needed" and "signalling integrity protection required" are not compatible.

After the A2X DIRECT LINK ESTABLISHMENT REQUEST message is generated, the initiating UE shall pass this message to the lower layers for transmission along with:

a) the initiating UE’s layer-2 ID for unicast communication and the destination layer-2 ID used for unicast initial signalling;

b) the NR Tx profile corresponding to the initial signalling of the A2X PC5 unicast link establishment and that is associated with the A2X service identifier (see clause 5.2.3), if available;

NOTE 3: The NR Tx profile is used by lower layers to determine the PC5 DRX parameter values (see 3GPP TS 38.300 [K]) for transmitting and receiving initial signalling of the A2X PC5 unicast link establishment.

And start timer Txxxx. The UE shall not send a new A2X DIRECT LINK ESTABLISHMENT REQUEST message to the same target UE identified by the same application layer ID while timer Txxxx is running. If the target user info IE is not included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message (i.e. A2X service oriented A2X PC5 unicast link establishment procedure), the initiating UE shall handle multiple A2X DIRECT LINK ESTABLISHMENT ACCEPT messages, if any, received from different target UEs for the establishment of multiple A2X PC5 unicast links before the expiry of timer Txxxx.

NOTE 4: In order to ensure successful A2X PC5 unicast link establishment, Txxxx should be set to a value larger than the sum of Tzzzz and Twwww.



Figure 6.1.2.2.2: UE oriented A2X PC5 unicast link establishment procedure

Initiating UE

Target UEs

Start Txxxx

A2X DIRECT LINK ESTABLISHMENT REQUEST

A2X DIRECT LINK ESTABLISHMENT ACCEPT

Txxxx expires

A2X DIRECT LINK ESTABLISHMENT ACCEPT

Figure 6.1.2.2.3: Service oriented A2X PC5 unicast link establishment procedure

##### 6.1.2.2.3 A2X PC5 unicast link establishment procedure accepted by the target UE

The target UE shall pass the NR Tx profile corresponding to the initial signalling of the A2X PC5 unicast link establishment and that is associated with the A2X service identifier the target UE is interested in (see clause 5.2.3), if available, to the lower layers.

NOTE 1: The NR Tx profile is used by lower layers to determine the PC5 DRX parameter values (see 3GPP TS 38.300 [K]) for transmitting and receiving initial signalling of the A2X PC5 unicast link establishment.

Upon receipt of an A2X DIRECT LINK ESTABLISHMENT REQUEST message, if the target UE accepts this request, the target UE shall uniquely assign a PC5 link identifier, create an A2X PC5 unicast link context and assign a layer-2 ID for this A2X PC5 unicast link. The newly assigned layer-2 ID replaces the target layer-2 ID as received on the A2X DIRECT LINK ESTABLISHMENT REQUEST message. Then the target UE shall store this assigned layer-2 ID and the source layer-2 ID used in the transport of this message provided by the lower layers in the A2X PC5 unicast link context. The target UE may initiate A2X PC5 unicast link authentication procedure as specified in clause 6.1.2.6.

NOTE 2: The target UE may reuse the target UE's layer-2 ID used in the transport of the A2X DIRECT LINK ESTABLISHMENT REQUEST message provided by the lower layers in case that the target UE's layer-2 ID has been used in previous A2X PC5 unicast link with the same peer.

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

In order to determine whether the A2X DIRECT LINK ESTABLISHMENT REQUEST message can be accepted or not, in case of IP communication, the target UE checks whether there is at least one common IP address configuration option supported by both the initiating UE and the target UE.

If the target UE accepts the A2X PC5 unicast link establishment procedure, the target UE shall create an A2X DIRECT LINK ESTABLISHMENT ACCEPT message. The target UE:

a) shall include the source user info set to the target UE's application layer ID received from upper layers;

b) shall include PQFI(s), the corresponding PC5 QoS parameters and the A2X service identifier(s) that the target UE accepts;

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

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

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

d) shall include a link local IPv6 address IE formed locally based on IETF RFC 4862 [L] if IP address configuration IE is set to "IPv6 address allocation not supported".

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

After the A2X DIRECT LINK ESTABLISHMENT ACCEPT message is generated, the target UE shall pass this message to the lower layers for transmission along with the initiating UE's layer-2 ID for unicast communication and the target UE's layer-2 ID for unicast communication, and shall start timer Tyyyy if at least one of A2X service identifiers for the A2X PC5 unicast links satisfies the privacy requirements as specified in clause 5.2.3.

After sending the A2X DIRECT LINK ESTABLISHMENT ACCEPT message, the target UE shall provide the following information along with the layer-2 IDs to the lower layer, which enables the lower layer to handle the coming PC5 signalling or traffic data:

a) the PC5 link identifier self-assigned for this A2X PC5 unicast link;

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

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

If the target UE accepts the A2X PC5 unicast link establishment request, then the target UE may perform the PC5 QoS flow establishment over A2X PC5 unicast link as specified in clause 6.1.2.12.

##### 6.1.2.2.4 A2X PC5 unicast link establishment procedure completion by the initiating UE

If the Target user info IE is included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message, upon receipt of the A2X DIRECT LINK ESTABLISHMENT ACCEPT message, the initiating UE shall stop timer Txxxx. If the Target user info IE is not included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message the initiating UE may keep the timer Txxxx running and continue to handle multiple response messages (i.e. the A2X DIRECT LINK ESTABLISHMENT ACCEPT message) from multiple target UEs.

For each of the A2X DIRECT LINK ESTABLISHMENT ACCEPT message received, the initiating UE shall uniquely assign a PC5 link identifier and create an A2X PC5 unicast link context for each of the A2X PC5 unicast link(s). Then the initiating UE shall store the source layer-2 ID and the destination layer-2 ID used in the transport of this message provided by the lower layers in the A2X PC5 unicast link context(s) to complete the establishment of the A2X PC5 unicast link with the target UE(s). From this time onward the initiating UE shall use the established link(s) for A2X communication over PC5 and additional PC5 signalling messages to the target UE(s).

After receiving the A2X DIRECT LINK ESTABLISHMENT ACCEPT message, the initiating UE shall provide the following information along with the layer-2 IDs to the lower layer, which enables the lower layer to handle the coming PC5 signalling or traffic data:

a) the PC5 link identifier self-assigned for this A2X PC5 unicast link;

b) PQFI(s) and its corresponding PC5 QoS parameters.

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

The initiating UE shall start timer Tyyyy if at least one of A2X service identifiers for the A2X PC5 unicast links satisfies the privacy requirements as specified in clause 5.2.3.

In addition, the initiating UE may perform the PC5 QoS flow establishment over A2X PC5 unicast link as specified in clause 6.1.2.12.

Upon expiry of the timer Txxxx, if the A2X DIRECT LINK ESTABLISHMENT REQUEST message did not include the Target User Info IE, and the initiating UE received at least one A2X DIRECT LINK ESTABLISHMENT ACCEPT message, it is up to the UE implementation to consider the A2X PC5 unicast link establishment procedure as complete or to restart the timer Txxxx.

##### 6.1.2.2.5 A2X PC5 unicast link establishment procedure not accepted by the target UE

If the A2X DIRECT LINK ESTABLISHMENT REQUEST message cannot be accepted, the target UE shall send an A2X DIRECT LINK ESTABLISHMENT REJECT message. The A2X DIRECT LINK ESTABLISHMENT REJECT message contains a PC5 signalling protocol cause IE set to one of the following cause values:

#1 direct communication to the target UE not allowed;

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

#5 lack of resources for A2X PC5 unicast link; or

#111 protocol error, unspecified.

If the target UE is not allowed to accept the A2X DIRECT LINK ESTABLISHMENT REQUEST message, e.g. based on operator policy or configuration parameters for A2X communication over PC5 as specified in clause 5.2.3, the target UE shall send an A2X DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #1 "direct communication to the target UE not allowed".

For a received A2X DIRECT LINK ESTABLISHMENT REQUEST message from a layer-2 ID (for unicast communication), if the target UE already has an existing link established to a UE using this layer-2 ID or is currently processing an A2X DIRECT LINK ESTABLISHMENT REQUEST message from the same layer-2 ID, and with one of following parameters different from the existing link or the link for which the link establishment is in progress:

a) the source user info;

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

c) security policy,

the target UE shall send an A2X DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #3 "conflict of layer-2 ID for unicast communication is detected".

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

If the A2X PC5 unicast link establishment fails due to the congestion problems, the implementation-specific maximum number of established A2X NR-PC5 unicast links has been reached, or other temporary lower layer problems causing resource constraints, the target UE shall send an A2X DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #5 "lack of resources for A2X PC5 unicast link". If the A2X PC5 unicast link establishment fails due to other reasons, the target UE shall send an A2X DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #111 "protocol error, unspecified".

After sending the A2X DIRECT LINK ESTABLISHMENT REJECT message, the target UE shall provide the initiating UE's layer-2 ID for unicast communication and the target UE's layer-2 ID for unicast communication to the lower layer.

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

Upon receipt of the A2X DIRECT LINK ESTABLISHMENT REJECT message, if the Target user info is included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message, the initiating UE shall stop timer Txxxx and abort the A2X PC5 unicast link establishment procedure. If the PC5 signalling protocol cause value in the A2X DIRECT LINK ESTABLISHMENT REJECT message is #1 "direct communication to the target UE not allowed" or #5 "lack of resources for A2X PC5 unicast link", then the UE shall not attempt to start the A2X PC5 unicast link establishment procedure with the same target UE at least for a time period T.

NOTE: The length of time period T is UE implementation specific and can be different for the case when the UE receives PC5 signalling protocol cause value #1 "direct communication to the target UE not allowed" or when the UE receives PC5 signalling protocol cause value #5 "lack of resources for A2X PC5 unicast link".

After receiving the A2X DIRECT LINK ESTABLISHMENT REJECT message, the initiating UE shall provide the initiating UE's layer-2 ID for unicast communication and the target UE's layer-2 ID for unicast communication to the lower layer.

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

##### 6.1.2.2.6 Abnormal cases

###### 6.1.2.2.6.1 Abnormal cases at the initiating UE

If timer Txxxx expires and the Target user info IE is included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message, the initiating UE shall retransmit the A2X DIRECT LINK ESTABLISHMENT REQUEST message and restart timer Txxxx. After reaching the maximum number of allowed retransmissions, the initiating UE shall abort the A2X PC5 unicast link establishment procedure and may notify the upper layer that the target UE is unreachable.

Upon expiry of the timer Txxxx, if the A2X DIRECT LINK ESTABLISHMENT REQUEST message did not include the Target User Info IE and the initiating UE did not receive any A2X DIRECT LINK ESTABLISHMENT ACCEPT message, the initiating UE may retransmit the A2X DIRECT LINK ESTABLISHMENT REQUEST message and restart timer Txxxx. If the A2X DIRECT LINK ESTABLISHMENT REQUEST message did not include the Target User Info IE and the initiating UE did not receive any A2X DIRECT LINK ESTABLISHMENT ACCEPT message, then after reaching the maximum number of allowed retransmissions, the initiating UE shall abort the A2X PC5 unicast link establishment procedure and may notify the upper layer that no target UE is available.

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

If the need to establish a link no longer exists before the procedure is completed, the initiating UE shall abort the procedure.

When the initiating UE aborts the A2X PC5 unicast link establishment procedure, the initiating UE shall provide the initiating UE's layer-2 ID for unicast communication and the target UE's layer-2 ID for unicast communication to the lower layer.

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

###### 6.1.2.2.6.2 Abnormal cases at the target UE

For a received A2X DIRECT LINK ESTABLISHMENT REQUEST message from a source layer-2 ID (for unicast communication), if the target UE already has an existing link established to the UE known to use the same source layer-2 ID, the same source user info, the same type of data (IP or non-IP) and the same security policy, the UE shall process the new request. However, the target UE shall only delete the existing link context after the new link establishment procedure succeeds.

Editor's note (pCR , UAS\_Ph2): security requirements to be added based on SA3 conclusions when available.

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

## X.3 Timers of A2X PC5 unicast link management procedures

Table X.3.1: A2X PC5 unicast link management timers

| TIMER NUM. | | TIMER VALUE | CAUSE OF START | NORMAL STOP | ON  EXPIRY |
| --- | --- | --- | --- | --- | --- |
| Txxxx | | 8s  NOTE 1 | Upon sending an A2X DIRECT LINK ESTABLISHMENT REQUEST message | Upon receiving an A2X DIRECT LINK ESTABLISHMENT ACCEPT or A2X DIRECT LINK ESTABLISHMENT REJECT message from the target UE if the Target user info is included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message | Retransmission of A2X DIRECT LINK ESTABLISHMENT REQUEST message if the Target user info is included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message; or  may abort the ongoing procedure if the Target user info is not included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message |
| Taaaa | | 5s | Upon sending an A2X DIRECT LINK MODIFICATION REQUEST message | Upon receiving a A2X DIRECT LINK MODIFICATION ACCEPT or A2X DIRECT LINK MODIFICATION REJECT or A2X DIRECT LINK RELEASE REQUEST message from the target UE | Retransmission of A2X DIRECT LINK MODIFICATION REQUEST message |
| Tcccc | | 5s | Upon sending an A2X DIRECT LINK RELEASE REQUEST message | Upon receiving an A2X DIRECT LINK RELEASE ACCEPT message from the target UE | Retransmission of A2X DIRECT LINK RELEASE REQUEST message |
| Tbbbb | | Default 10m  NOTE 2 | Upon receiving a Maximum inactivity period in an A2X DIRECT LINK KEEPALIVE REQUEST message, receiving a PC5 signalling message or receiving PC5 user plane data | Upon receiving a PC5 signalling message or PC5 user plane data | Either initiate the A2X PC5 unicast link keep-alive procedure or the A2X PC5 unicast link release procedure |
| Tzzzz | | 2s | Upon sending an A2X DIRECT LINK AUTHENTICATION REQUEST message | Upon receiving an A2X DIRECT LINK AUTHENTICATION RESPONSE or A2X DIRECT LINK AUTHENTICATION REJECT message from the target UE | Retransmission of A2X DIRECT LINK AUTHENTICATION REQUEST message |
| Tyyyy | | NOTE 2 | Upon establishing an A2X PC5 unicast link and at least one of A2X service identifier for the A2X PC5 unicast link satisfying the privacy requirements or  upon completing an A2X PC5 unicast link identifier update and at least one of A2X service identifiers for the A2X PC5 unicast link satisfying the privacy requirements. | Upon completing an A2X PC5 unicast link identifier update and if available or accepting a A2X DIRECT LINK IDENTIFIER UPDATE REQUEST message or upon an A2X PC5 unicast link release and if available | Transmission of A2X DIRECT LINK IDENTIFIER UPDATE REQUEST message |
| NOTE 1 If the Target user info is not included in the A2X DIRECT LINK ESTABLISHMENT REQUEST message, then the initiating UE may keep the timer Txxxx running upon receiving A2X DIRECT LINK ESTABLISHMENT ACCEPT message.  NOTE 2 The value of this timer is the privacy timer value which is one of the configuration parameters for A2X communication over PC5 (see clause 5.2) and it is specified in 3GPP TS 24.578 [C] clause 5.3. | | | | | |

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