**3GPP TSG-CT WG1 Meeting #124-eC1-203270**

**Electronic meeting, 2-10 June 2020 was C1-202745**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **24.587** | **CR** | **0020** | **rev** | **3** | **Current version:** | **16.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:***  | Handling of PC5 unicast QoS flow match and establishment |
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| ***Source to WG:*** | vivo, Huawei, HiSilicon, Ericsson, OPPO |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | eV2XARC |  | ***Date:*** | 2020-05-26 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | *Rel-16* |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | How to handle the PC5 QoS flow match and establishment over PC5 unicast link is still missing.Accroding to the descriptions of PC5 QoS Flow in clause 5.4.1.1.2 of TS23.287, the basic principles of PC5 unicast QoS flow match and establishment can be summarized as follows:Once UE receives the request or data from upper layer, the UE shall determine whether there is any existing PC5 QoS flows matching the service data or request based on the existing PC5 QoS rules* + if there is no PC5 QoS rule(s) for the existing PC5 QoS flows matching the service data or request, the UE shall derive the PC5 QoS parameters of this request or data according to the PC5 QoS mapping configuration defined in clause 5.2.3
		- then the UE determines whether there is existing PC5 QoS Flow that fulfils the derived PC5 QoS parameters based on this PC5 QoS flow context which includes the associated V2X service identifier and the PC5 QoS parameters
			* if there is no existing PC5 QoS flow that fulfils the derived PC5 QoS parameters
				+ The UE creates a new PC5 QoS Flow for the derived PC5 QoS parameters; and
				+ The UE then assigns a PFI and derives PC5 QoS Rule for this PC5 QoS Flow
			* Otherwise, the UE updates the PC5 Packet Filter Set in the PC5 QoS Rule for such PC5 QoS Flow
	+ Otherwise, UE sends the request or data by using the existing PC5 QoS flows whose PC5 QoS rule is matched.

This basic principles of PC5 QoS flow match and establishment are applied to broadcast, groupcast and unicast.Reason to revise the contribution after agreed in last meeting:1. Agreed paper S2-2003431 further specifies that:
* UE maintains the mappings of PFIs to the PC5 QoS Context and PC5 QoS Rule(s) for each PC5 QoS Flow identified by a PC5 QoS Flow Identifier (PFI);
* the content of PC5 QoS Context; and
* the content of PC5 QoS rule.

In order to align with stage 2’s progress, updates are needed.1. UE’s behaviors of handling PC5 QoS flow are not comlete when initiating UE initiates the link establishment or modificatio procedure, such as PQFI assigning, PC5 QoS parameters deriving or PC5 QoS flow match.
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| ***Summary of change:*** | Add the handling of the PC5 QoS flow match and establishment over PC5 unicast link based on the above summary.Changes in this contribution:1. Add initiating UE’s behaviors of handling PC5 QoS flow when initiating the link establishment or modification procedure;
2. Delete the initiating UE’s behaviors of matching PC5 QoS flow which was added in clause 6.1.2.3.4 during last meeting;
3. Add the content of PC5 QoS Context;
4. Specify the PC5 QoS flow can associate with one or more PC5 QoS rules; and
5. Remove the EN about packet filters.

NOTE: The highlighted parts are only for the purpose of distinguishing, and will be deleted after agreed. |
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| ***Consequences if not approved:*** | No specification for handling the PC5 QoS flow match and establishment over PC5 unicast link. |
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| ***Clauses affected:*** | 6.1.2.2.2, 6.1.2.2.3, 6.1.2.2.4, 6.1.2.3.2, 6.1.2.3.3, 6.1.2.3.4, 6.1.2.X(new), 6.1.2.y(new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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

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

Editor’s note: This section needs to be revisited after SA3 have determined the full set of security requirements for unicast link establishment.

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

a) a request from upper layers to transmit the packet for V2X service over PC5;

b) 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);

c) the link layer identifier for the unicast initial signaling (i.e. destination layer 2 ID used for unicast initial signaling) is available to the initiating UE (e.g. pre-configured, obtained as specified in clause 5.2.3 or known via prior V2X communication);

d) the initiating UE is either authorised for V2X communication over PC5 in NR in the serving PLMN, or has a valid authorization for V2X communication over PC5 in NR when not served by E-UTRAN and not served by NR; and

e) there is no existing PC5 unicast link for the pair of peer application layer IDs and the network layer protocol of this PC5 unicast link are identical to those required by the upper layer in the initiating UE for this V2X service.

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.X.

In order to initiate the PC5 unicast link establishment procedure, the initiating UE shall create a 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 V2X service identifier received from upper layer;

c) may include the target user info set to the target UE’s application layer ID if received from upper layers; and

d) shall include the security establishment information.

Editor’s note: The parameters in the security establishment information will be defined by SA3.

After the DIRECT LINK ESTABLISHMENT REQUEST message is generated, the initiating 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 destination layer 2 ID used for unicast initial signaling, and start timer T5000. The UE shall not send a new DIRECT LINK ESTABLISHMENT REQUEST message to the same target UE identified by the same application layer ID while timer T5000 is running.



Figure 6.1.2.2.2: PC5 unicast link establishment procedure

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

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

Upon receipt of a DIRECT LINK ESTABLISHMENT REQUEST message, the target UE shall assign a layer-2 ID for this PC5 unicast link and store this assigned layer-2 ID and the source layer 2 ID used in the transport of this message provided by the lower layers. This pair of layer-2 IDs is associated with a PC5 unicast link context.

If:

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

b) the target user info IE is not included in the DIRECT LINK ESTABLISHMENT REQUEST message and the target UE is interested in the V2X service identified by the V2X service identifier in the DIRECT LINK ESTABLISHMENT REQUEST message;

then the target UE shall either identify an existing security context with the initiating UE, or establish a new security context by performing one or more PC5 unicast link authentication procedures as specified in clause 6.1.2.6, and performing the PC5 unicast link security mode control procedure as specified in clause 6.1.2.7.

Upon successful completion of the PC5 unicast link security mode control procedure, in order to determine whether the 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 PC5 unicast link establishment procedure, the target UE shall create a 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 a PQFI and the corresponding PC5 QoS parameters;

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

1) "IPv6 router" if only 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) may include a link local IPv6 address IE formed locally based on IETF RFC 4862 [16] if IP address configuration IE is set to "IPv6 address allocation not supported" and the received DIRECT LINK ESTABLISHMENT REQUEST message included a link local IPv6 address IE.

If the target UE accepts the PC5 unicast link establishment request, then the target UE may perform the PC5 QoS flow establishment over PC5 unicast link as specified in clause 6.1.2.X.

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

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

Upon receipt of the DIRECT LINK ESTABLISHMENT ACCEPT message, the initiating UE shall stop timer T5000 and store the source layer-2 ID and the destination Layer-2 ID used in the transport of this message provided by the lower layers. This pair of layer-2 IDs shall be associated with a PC5 unicast link context. From this time onward the initiating UE shall use the established link for V2X communication over PC5 and additional PC5 signalling messages to the target UE.

In addition, the initiating UE may perform the PC5 QoS flow establishment over PC5 unicast link as specified in clause 6.1.2.X.

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

##### 6.1.2.3.2 PC5 unicast link modification procedure initiated by initiating UE

The initiating UE shall meet the following pre-conditions before initiating this procedure for adding a new V2X service to the existing PC5 unicast link:

a) there is a PC5 unicast link between the initiating UE and the target UE; and

b) the pair of application layer IDs and the network layer protocol of this PC5 unicast link are identical to those required by the application layer in the initiating UE for this V2X service.

After receiving the service data or request from the upper layers, the initiating UE shall perform the PC5 QoS flow match as apecified in clause 6.1.2.Y. If there is no matched PC5 QoS flow, 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.X.

If the PC5 unicast link modification procedure is to add a new V2X service to the existing PC5 unicast link, the initiating UE shall create a DIRECT LINK MODIFICATION REQUEST message. In this message, the initiating UE:

a) shall include the V2X service identifier received from upper layer;

b) shall include the PQFI and the corresponding PC5 QoS parameters; and

c) shall include the link modification operation code set to "add new V2X service".

If the PC5 unicast link modification procedure is to remove an existing V2X service from the existing PC5 unicast link, the initiating UE shall create a DIRECT LINK MODIFICATION REQUEST message. In this message, the initiating UE:

a) shall include the V2X service identifier received from upper layer; and

b) shall include the link modification operation code set to "remove existing V2X service".

If the PC5 unicast link modification procedure is to add new PC5 QoS flow(s) to the existing PC5 unicast link, the initiating UE shall create a DIRECT LINK MODIFICATION REQUEST message. In this message, initiating UE:

a) shall include the V2X service identifier received from upper layer;

b) shall include the PQFI(s) and the corresponding PC5 QoS parameters; and

c) shall include the link modification operation code set to "add new PC5 QoS flow(s)".

If the PC5 unicast link modification procedure is to modify any PC5 QoS flow(s) in the existing PC5 unicast link, the initiating UE shall create a DIRECT LINK MODIFICATION REQUEST message. In this message, the initiating UE:

a) shall include the PQFI(s) and the corresponding PC5 QoS parameters; and

b) shall include the link modification operation code set to "modify existing PC5 QoS flow(s)".

If the PC5 unicast link modification procedure is to remove any PC5 QoS flow(s) from the existing PC5 unicast link, the initiating UE shall create a DIRECT LINK MODIFICATION REQUEST message. In this message, the initiating UE:

a) shall include the PQFI(s); and

b) shall include the link modification operation code set to "remove existing PC5 QoS flow(s)".

Editor's note: It is FFS whether a DIRECT LINK MODIFICATION REQUEST message can contain multiple modification operations.

After the DIRECT LINK MODIFICATION REQUEST message is generated, the initiating 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 start timer T5001. The UE shall not send a new DIRECT LINK MODIFICATION REQUEST message to the same target UE while timer T5001 is running.

Editor’s note: The details of the timer T5001 are FFS.



Figure 6.1.2.3.2: PC5 unicast link modification procedure

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

##### 6.1.2.3.3 PC5 unicast link modification procedure accepted by the target UE

If the DIRECT LINK MODIFICATION REQUEST message is accepted, the target UE shall respond with the DIRECT LINK MODIFICATION ACCEPT message.

If the DIRECT LINK MODIFICATION REQUEST message is to add a new V2X service, add new PC5 QoS flow(s) or modify any existing PC5 QoS flow(s) in the PC5 unicast link, the target UE shall include in the DIRECT LINK MODIFICATION ACCEPT message:

a) the PQFI(s) and the corresponding PC5 QoS parameters that the target UE accepts.

If the DIRECT LINK MODIFICATION REQUEST message is to remove an existing V2X service from the PC5 unicast link, the target UE shall delete the V2X service identifier received in the DIRECT LINK MODIFICATION REQUEST message and the corresponding PQFI(s) and PC5 QoS parameters from the profile associated with the PC5 unicast link.

If the DIRECT LINK MODIFICATION REQUEST message is to remove existing PC5 QoS flow(s) from the PC5 unicast link, the target UE shall delete the PQFI(s) and the corresponding PC5 QoS parameters from the profile associated with the PC5 unicast link.

If the target UE accepts the PC5 unicast link modification request, then the target UE may perform the PC5 QoS flow establishment over PC5 unicast link as specified in clause 6.1.2.X and perform the PC5 QoS flow match over PC5 unicast link as specified in clause 6.1.2.Y.

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

##### 6.1.2.3.4 PC5 unicast link modification procedure completion by the initiating UE

Upon receipt of the DIRECT LINK MODIFICATION ACCEPT message, the initiating UE shall stop timer T5001.

In addition, the initiating UE may perform the PC5 QoS flow establishment over PC5 unicast link as specified in clause 6.1.2.X.

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

#### 6.1.2.X PC5 QoS flow establishment over PC5 unicast link

In order to establish a PC5 QoS flow establishment over PC5 unicast link, the UE shall derive the PC5 QoS parameters based on the V2X application requirements provided by the upper layers (if available) and the V2X service type (e.g. PSID or ITS-AID) according to the PC5 QoS mapping rules defined in clause 5.2.3. The UE shall create the PC5 QoS flow(s) based on the derived PC5 QoS parameters. For each PC5 QoS flow to be created, the UE shall perform the following operations:

a) self-assign a PQFI;

b) create a PC5 QoS flow context, which contains:

1) the PQFI;

2) the V2X service indentifier(s); and

3) the derived PC5 QoS parameters;

c) create a new PC5 QoS rule which contains:

1) a PC5 QoS rule identifier;

2) the PQFI;

3) a set of packet filters; and

4) a precedence value; and

d) pass the following parameters to the lower layers:

1) the PQFI;

2) the PC5 QoS parameters;

3) the PC5 link identifier; and;

4) optionally, the source and destination layer-2 IDs.

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

#### 6.1.2.Y PC5 QoS flow match over PC5 unicast link

When service data or request from the upper layers is received, the UE determines if there is any existing PC5 QoS flow(s) matching the service data or request, i.e. based on the PC5 QoS rules for the existing PC5 QoS flow(s).

If there is no PC5 QoS rules for the existing PC5 QoS flow(s) matching the service data or request, the UE shall derive the PC5 QoS parameters based on the V2X application requirements provided by the upper layers (if available) and the V2X service type (e.g. PSID or ITS-AID) according to the PC5 QoS mapping rules defined in clause 5.2.3 and shall perform the following:

a) if there is no existing PC5 QoS flow that fulfils the derived PC5 QoS parameters, then the UE shall create a new PC5 QoS flow as specified in clause 6.1.2.X;

b) if there is an existing PC5 QoS flow that fulfils the derived PC5 QoS parameters, then the UE shall update the PC5 packet filter set in the PC5 QoS rule of this PC5 QoS flow, e.g. add the new packet filter in the PC5 QoS rule of this existing PC5 QoS flow; and

c) the UE shall use the new PC5 QoS flow created as described in bullet a) or the existing PC5 QoS flow with the updated PC5 QoS rules as described in bullet b) to perform the transmission of V2X communication over PC5 as specified in clause 6.1.2.9.

If there is a PC5 QoS rule for the existing PC5 QoS flow matching the service data or request, the UE shall use this existing PC5 QoS flow to perform transmission of V2X communication over PC5 as specified in clause 6.1.2.9.

\* \* \* End of changes \* \* \* \*