**3GPP TSG- Meeting #10-eR2-** **2005957**

**Electronic Meeting, 1st– 12th June 2020**

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

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| ***Title:***  | Correction for NR sidelink communication |
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| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 2020-06-03 |
|  |  |  |  |  |
| ***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:*** | From R2-2005075 (Ericsson, Nokia):1. In current TS 38.300 v16.1.0, it states “For unicast, channel state information reference signal (CSI-RS) is supported for CSI measurement and reporting in sidelink. A CSI report is carried in a MAC CE.” However, a CSI report over sidelink should be carried in a sidelink MAC CE.

Besides, some editorial corrections are proposed.From R2-2005133 (Lenovo, Motorola Mobility):1. Sidelink configuration is proposed to be included in CHO configuration from target cell as legacy handover. According to TS38.300 for NR V2X, the UE activates the configured sidelink grant Type 1 upon reception of the handover command, which can not be applied to the case of CHO. Therefore, we can be changed to, for example, ‘*If provided, the UE activates the configured sidelink grant Type 1 upon execution of the handover command.*’

From R2-2005465 (Huawei, HiSilicon):1. Clarify that the terminology “PC5-C” is dedicated for the CP protocol stack in the AS, i.e. being used for PC5-RRC. Do not use it to describe also PC5-S in TS 38.300. Use the logical channel to distinguish PC5-C protocol stack, and change “PC5-C protocol stack for RRC” to “PC5-C protocol stack for SCCH” in Figure 16.9.2.1-1 of TS 38.300.
2. Clarify in 16.9.2.2 of TS 38.300 that SCCH is a sidelink channel for transmitting control information “i.e. PC5 RRC messages” from one UE to the other UE(s).
3. In 16.9.2.3 of TS 38.300, either clarify that “either UM or AM is used in unicast transmission for a specific SLRB” or clarify that “both UM and AM are used in unicast transmission”.
4. Change “SL-SRB configuration” to “SL-DRB configurations” wherever it is used to describe the configurable SLRB (pre-)configurations in TS 38.300.
5. In TS 38.300, remove the redundant condition “if the T400 is expired as specified in TS 38.331 [12]” from the conditions triggering PC5-RRC connection release (as it is already covered by other conditions).
6. Clarify in TS 38.300 that when beam failure or physical layer problem occurs on NR Uu, the UE can continue using configured sidelink grant Type 1, until initiation of RRC connection re-establishment as in TS 38.331.
7. In 16.9.4.1 of TS 38.300, add a restriction that for the NR Uu control of V2X sidelink communication case dynamic scheduling for V2X side link communication is not support.
8. In 16.9.4.1 of TS 38.300, add the description for prioritization between V2X sidelink transmission and NR uplink transmission, i.e. this is done based on the priorities of the V2X sidelink transmission and a threshold configured by the NG-RAN.
9. In 16.9.4.2/3 of TS 38.300, clarify that the UE in RRC\_CONNECTED/IDLE/INACTIVE performs NR sidelink communication and/or V2X sidelink communication “if configured by the upper layers”.
10. In 16.9.4.3 of TS 38.300, change the current description of SLRB configuration handling from RRC\_CONNECTED to RRC\_IDLE/INACTIVE to a more generic description that can cover all state transition cases.
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| ***Summary of change:*** | Chagne 1):Section 5.7.1* Change “transmission mode” to “sidelink resource allocation modes” to be consistent with the title of section 5.7.2.

Section 5.7.4.3* Add “sidelink” before MAC CE to distinguish it from Uu MAC CE

Change 2) Section 16.9.3.2:* Change “reception” to “execution” in “During handover, the UE can be provided with configured sidelink grants via handover command, regardless of the type. If provided, the UE activates the configured sidelink grant Type 1 upon reception execution of the handover command.”

Change 3) Section 16.9.2.1: * Remove abbreviation e.g. PC5-C, PC5-U from the text to follow the same/similar phrasing as in 36.300. Add SCCH before RRC and PC5-S.

Change 4) Section 16.9.2.2:* Add “(i.e. PC5 RRC messages)” after “control information”

Change 5) Section 16.9.2.3* Change “either UM or AM is used” to “both UM and AM are used”

Change 6) Section 16.9.2.6, 16.9.4.1, 16.9.4.2, 16.9.4.3:* Change “SLRB configuration” to “SL-DRB configurations”

Change 7) Section 16.9.2.6:* remove the redundant condition “if the T400 is expired as specified in TS 38.331 [12]”

Change 8) Section 16.9.3.2:* Add “until initiation of the RRC connection re-establishment procedure as specified in TS 38.331 [12].” After “When beam failure or physical layer problem occurs on NR Uu, the UE can continue using the configured sidelink grant Type 1”

Change 9) Section 16.9.4.1:* Add” with the restriction that the dynamic scheduling for V2X sidelink communication (i.e. based on SL-V-RNT) is not supported” after “If configured, the UE performs V2X sidelink communication as specified in TS 36.300 [2] unless otherwise specified”

Change 10) Section 16.9.4.1:* Add “When the UE cannot simultaneously perform both V2X sidelink transmission and NR uplink transmission in time domain, prioritization between both transmissions is done based on the priorities (i.e. PPPP) of V2X sidelink communication and a threshold configured by the NG-RAN”

Change 11) Section 16.9.4.2, 16.9.4.3:* Clarify that the UE in RRC\_CONNECTED/IDLE/INACTIVE performs NR sidelink communication and/or V2X sidelink communication “if configured by the upper layers”.

Change 12) Section 16.9.2.3* change the current description of SLRB configuration handling from RRC\_CONNECTED to RRC\_IDLE/INACTIVE to a more generic description that can cover all state transition cases.
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| ***Consequences if not approved:*** | Some descriptions about NR sidelink in the current spec are imprecise and confusing.  |
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| ***Clauses affected:*** | 5.7.1, 5.7.4.3, 16.9.3.2, 16.9.2.1, 16.9.2.2, 16.9.2.3, 16.9.2.6, 16.9.3.2, 16.9.4.1, 16.9.4.2, 16.9.4.3 |
|  |  |
|  | **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:*** |  |

START OF THE CHANGE

## 5.7 Sidelink

### 5.7.1 General

Sidelink supports UE-to-UE direct communication using the sidelink resource allocation modes, physical-layer signals/channels, and physical layer procedures below.

### 5.7.2 Sidelink resource allocation modes

Two sidelink resource allocation modes are supported: mode 1 and mode 2. In mode 1, the sidelink resource allocation is provided by the network. In mode 2, UE decides the SL transmission resources and timing in the resource pool.

### 5.7.3 Physical sidelink channels and signals

Physical Sidelink Control Channel (PSCCH) indicates resource and other transmission parameters used by a UE for PSSCH. PSCCH transmission is associated with a DM-RS.

Physical Sidelink Shared Channel (PSSCH) transmits the TBs of data themselves, and control information for HARQ procedures and CSI feedback triggers, etc. At least 5 OFDM symbols within a slot are used for PSSCH transmission. PSSCH transmission is associated with a DM-RS and may be associated with a PT-RS.

Physical Sidelink Feedback Channel (PSFCH) carries HARQ feedback over the sidelink from a UE which is an intended recipient of a PSSCH transmission to the UE which performed the transmission. PSFCH sequence is transmitted in one PRB repeated over two OFDM symbols near the end of the sidelink resource in a slot.

The Sidelink synchronization signal consists of sidelink primary and sidelink secondary synchronization signals (S-PSS, S-SSS), each occupying 2 symbols and 127 subcarriers. Physical Sidelink Broadcast Channel (PSBCH) occupies 7 and 5 symbols for normal and extended cyclic prefix cases respectively, including the associated DM-RS.

### 5.7.4 Physical layer procedures for sidelink

#### 5.7.4.1 HARQ feedback

Sidelink HARQ feedback uses PSFCH and can be operated in one of two options. In one option, PSFCH transmits either ACK or NACK using a resource dedicated to a single PSFCH transmitting UE. In another option, PSFCH transmits NACK, or no PSFCH signal is transmitted, on a resource that can be shared by multiple PSFCH transmitting UEs.

In sidelink resource allocation mode 1, a UE which received PSFCH can report sidelink HARQ feedback to gNB via PUCCH or PUSCH.

#### 5.7.4.2 Power Control

For in-coverage operation, the power spectral density of the sidelink transmissions can be adjusted based on the pathloss from the gNB.

For unicast, the power spectral density of some sidelink transmissions can be adjusted based on the pathloss between the two communicating UEs.

#### 5.7.4.3 CSI report

For unicast, channel state information reference signal (CSI-RS) is supported for CSI measurement and reporting in sidelink. A CSI report is carried in a sidelink MAC CE.

### 5.7.5 Physical layer measurement definition

For measurement on the sidelink, the following UE measurement quantities are supported:

- PSBCH reference signal received power (PSBCH RSRP);

- PSSCH reference signal received power (PSSCH-RSRP);

- PSСCH reference signal received power (PSCCH-RSRP);

- Sidelink received signal strength indicator (SL RSSI);

- Sidelink channel occupancy ratio (SL CR);

- Sidelink channel busy ratio (SL CBR).

END OF THE CHANGE

START OF THE CHANGE

16.9 Sidelink

16.9.1 General

In this subclause, an overview of NR sidelink communication and how NG-RAN supports NR sidelink communication and V2X sidelink communication is given. V2X sidelink communication are specified in TS 36.300 [2].

The NG-RAN architecture supports the PC5 interface as illustrated in Figure 16.9.1-1. Sidelink transmission and reception over the PC5 interface are supported when the UE is inside NG-RAN coverage, irrespective of which RRC state the UE is in, and when the UE is outside NG-RAN coverage.

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**Figure 16.9.1-1: NG-RAN Architecture supporting the PC5 interface**

Support of V2X services via the PC5 interface can be provided by NR sidelink communication and/or V2X sidelink communication. NR sidelink communication may be used to support other services than V2X services.

NR sidelink communication can support one of three types of transmission modes for a pair of a Source Layer-2 ID and a Destination Layer-2 ID in the AS:

- **Unicast transmission**, characterized by:

- Support of one PC5-RRC connection between peer UEs for the pair;

- Transmission and reception of control information and user traffic between peer UEs in sidelink;

- Support of sidelink HARQ feedback;

- Support of RLC AM;

- Detection of radio link failure for the PC5-RRC connection.

- **Groupcast transmission**, characterized by:

- Transmission and reception of user traffic among UEs belonging to a group in sidelink;

- Support of sidelink HARQ feedback.

- **Broadcast transmission**, characterized by:

- Transmission and reception of user traffic among UEs in sidelink.

16.9.2 Radio Protocol Architecture for NR sidelink communication

16.9.2.1 Overview

The AS protocol stack for the control plane for SCCH for RRC in the PC5 interface consists of RRC, PDCP, RLC and MAC sublayers, and the physical layer. The protocol stack of control plane for SCCH for RRC is shown in Figure 16.9.2.1-1.

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**Figure 16.9.2.1-1: Control plane protocol stack for SCCH for RRC.**

For support of PC5-S protocol specified in TS 23.287 [40], PC5-S is located on top of PDCP, RLC and MAC sublayers, and the physical layer in the control plane protocol stack for SCCH for PC5-S, as shown in Figure 16.9.2.1-2.

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**Figure 16.9.2.1-2: Control plane protocol stack for SCCH for PC5-S.**

The AS protocol stack for SBCCH in the PC5 interface consists of RRC, RLC, MAC sublayers, and the physical layer as shown below in Figure 16.9.2.1-3.

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**Figure 16.9.2.1-3: Control plane protocol stack for SBCCH.**

The AS protocol stack for user plane in the PC5 interface consists of SDAP, PDCP, RLC and MAC sublayers, and the physical layer. The protocol stack of user plane is shown in Figure 16.9.2.1-4.

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**Figure 16.9.2.1-4: PC5 user plane protocol stack.**

Sidelink Radio bearers (SLRB) are categorized into two groups: sidelink data radio bearers (SL DRB) for user plane data and sidelink signalling radio bearers (SL SRB) for control plane data. Separate SL SRBs using different SCCHs are configured for PC5-RRC and PC5-S signalling respectively.

16.9.2.2 MAC

The MAC sublayer provides the following services and functions over the PC5 interface in addition to the services and functions specified in subclause 6.2.1:

- Radio resource selection;

- Packet filtering;

- Priority handling between uplink and sidelink transmissions for a given UE;

- Sidelink CSI reporting.

With LCP restrictions in MAC, only sidelink logical channels belonging to the same destination can be multiplexed into a MAC PDU for every unicast, groupcast and broadcast transmission which is associated to the destination. NG-RAN can also control whether a sidelink logical channel can utilise the resources allocated to a configured sidelink grant Type 1 (see subclause 16.9.3.2).

For packet filtering, a SL-SCH MAC header including portions of both Source Layer-2 ID and a Destination Layer-2 ID is added to each MAC PDU as specified in subclause 8.4. LCID included within a MAC subheader uniquely identifies a logical channel within the scope of the Source Layer-2 ID and Destination Layer-2 ID combination.

The following logical channels are used in sidelink:

- Sidelink Control Channel (SCCH): a sidelink channel for transmitting control information (i.e. PC5 RRC messages) from one UE to other UE(s);

- Sidelink Traffic Channel (STCH): a sidelink channel for transmitting user information from one UE to other UE(s);

- Sidelink Broadcast Control Channel (SBCCH): a sidelink channel for broadcasting sidelink system information from one UE to other UE(s).

The following connections between logical channels and transport channels exist:

- SCCH can be mapped to SL-SCH;

- STCH can be mapped to SL-SCH;

- SBCCH can be mapped to SL-BCH.

16.9.2.3 RLC

The services and functions of the RLC sublayer as specified in subclause 6.3.2 are supported for sidelink. TM is used for SBCCH. Both UM and AM is used in unicast transmission while UM is used in groupcast or broadcast transmission. For UM, only unidirectional transmission is supported for groupcast and broadcast.

16.9.2.4 PDCP

The services and functions of the PDCP sublayer as specified in subclause 6.4.1 are supported for sidelink with some restrictions:

- Out-of-order delivery is supported only for unicast transmission;

- Duplication is not supported over the PC5 interface.

16.9.2.5 SDAP

The SDAP sublayer provides the following service and function over the PC5 interface:

- Mapping between a QoS flow and a sidelink data radio bearer.

There is one SDAP entity per destination for one of unicast, groupcast and broadcast which is associated to the destination. Reflective QoS is not supported over the PC5 interface.

16.9.2.6 RRC

The RRC sublayer provides the following services and functions over the PC5 interface:

- Transfer of a PC5-RRC message between peer UEs;

- Maintenance and release of a PC5-RRC connection between two UEs;

- Detection of sidelink radio link failure for a PC5-RRC connection.

A PC5-RRC connection is a logical connection between two UEs for a pair of Source and Destination Layer-2 IDs which is considered to be established after a corresponding PC5 unicast link is established as specified in TS 23.287 [40]. There is one-to-one correspondence between the PC5-RRC connection and the PC5 unicast link. A UE may have multiple PC5-RRC connections with one or more UEs for different pairs of Source and Destination Layer-2 IDs.

Separate PC5-RRC procedures and messages are used for a UE to transfer UE capability and sidelink configuration including SL-DRB configuration to the peer UE. Both peer UEs can exchange their own UE capability and sidelink configuration using separate bi-directional procedures in both sidelink directions.

If it is not interested in sidelink transmission, if sidelink RLF on the PC5-RRC connection is declared, or if the Layer-2 link release procedure is completed as specified in TS 23.287 [40], UE releases the PC5-RRC connection.

16.9.3 Radio Resource Allocation

16.9.3.1 General

The UE can operate in two modes for resource allocation in sidelink:

- Scheduled resource allocation, characterized by:

- The UE needs to be RRC\_CONNECTED in order to transmit data;

- NG-RAN schedules transmission resources.

- UE autonomous resource selection, characterized by:

- The UE can transmit data when inside NG-RAN coverage, irrespective of which RRC state the UE is in, and when outside NG-RAN coverage;

- The UE autonomously selects transmission resources from a pool of resources.

- For NR sidelink communication, the UE performs sidelink transmissions only on a single carrier.

16.9.3.2 Scheduled Resource Allocation

NG-RAN can dynamically allocate resources to the UE via the SL-RNTI on PDCCH(s) for NR sidelink Communication.

In addition, NG-RAN can allocate sidelink resources to UE with two types of configured sidelink grants:

- With type 1, RRC directly provides the configured sidelink grant only for NR sidelink communication;

- With type 2, RRC defines the periodicity of the configured sidelink grant while PDCCH can either signal and activate the configured sidelink grant, or deactivate it. The PDCCH is addressed to SL-CS-RNTI for NR sidelink communication and SL Semi-Persistent Scheduling V-RNTI for V2X sidelink communication.

For the UE performing NR sidelink communication, there can be more than one configured sidelink grant activated at a time on the carrier configured for sidelink transmission.

When beam failure or physical layer problem occurs on NR Uu, the UE can continue using the configured sidelink grant Type 1 until initiation of the RRC connection re-establishment procedure as specified in TS 38.331 [12]. During handover, the UE can be provided with configured sidelink grants via handover command, regardless of the type. If provided, the UE activates the configured sidelink grant Type 1 upon execution of the handover command.

The UE can send sidelink buffer status report to support scheduler operation in NG-RAN. The sidelink buffer status reports refer to the data that is buffered in for a group of logical channels (LCG) per destination in the UE. Eight LCGs are used for reporting of the sidelink buffer status reports. Two formats, which are SL BSR and truncated SL BSR, are used.

16.9.3.3 UE Autonomous Resource Selection

The UE autonomously selects sidelink grant from a pool of resources provided by broadcast system information or dedicated signalling while inside NG-RAN coverage or by pre-configuration while outside NG-RAN coverage.

For NR sidelink communication, the pools of resources can be provided for a given validity area where the UE does not need to acquire a new pool of resources while moving within the validity area, at least when this pool is provided by SIB (e.g. reuse valid area of NR SIB). NR SIB validity mechanism is reused to enable validity area for SL resource pool configured via broadcasted system information.

The UE is allowed to temporarily use UE autonomous resource selection with random selection for sidelink transmission based on configuration of the exceptional transmission resource pool as specified in TS 38.331 [12].

16.9.4 Uu Control

16.9.4.1 General

When a UE is inside NG-RAN coverage, NR sidelink communication and/or V2X sidelink communication can be configured and controlled by NG-RAN via dedicated signalling or system information:

- The UE should support and be authorized to perform NR sidelink communication and/or V2X sidelink communication in NG-RAN;

- If configured, the UE performs V2X sidelink communication as specified in TS 36.300 [2] unless otherwise specified, with the restriction that the dynamic scheduling for V2X sidelink communication (i.e. based on SL-V-RNT) is not supported;

- NG-RAN can provide the UE with intra-carrier sidelink configuration, inter-carrier sidelink configuration and anchor carrier which provides sidelink configuration via a Uu carrier for NR sidelink communication and/or V2X Sidelink communication;

- When the UE cannot simultaneously perform both NR sidelink transmission and NR uplink transmission in time domain, prioritization between both transmissions is done based on their priorities and thresholds configured by the NG-RAN. When the UE cannot simultaneously perform both V2X sidelink transmission and NR uplink transmission in time domain, prioritization between both transmissions is done based on the priorities (i.e. PPPP) of V2X sidelink communication and a threshold configured by the NG-RAN

When a UE is outside NG-RAN coverage, SL-DRB configuration(s) are preconfigured to the UE for NR sidelink communication. changes the RRC state but has not received the SLRB configuration(s) for the new RRC statesobtained in the original RRC state thefor the new RRC state

16.9.4.2 Control of connected UEs

The UE in RRC\_CONNECTED performs NR sidelink communication and/or V2X sidelink communication, if configured by the upper layers. The UE sends Sidelink UE Information to NG-RAN in order to request or release sidelink resources and report QoS information for each destination.

NG-RAN provides *RRCReconfiguration* to the UE in order to provide the UE with dedicated sidelink configuration. The *RRCReconfiguration* may include SL-DRB configuration(s) for NR sidelink communication as well as either sidelink scheduling configuration or resource pool configuration. If UE has received SLRB configuration via system information, UE should continue using the configuration to perform sidelink data transmissions and receptions until a new configuration is received via the *RRCReconfiguration*.

NG-RAN may also configure measurement and reporting of CBR and reporting of location information to the UE via *RRCReconfiguration*.

During handover, the UE performs sidelink transmission and reception based on configuration of the exceptional transmission resource pool or configured sidelink grant Type 1 and reception resource pool of the target cell as provided in the handover command.

16.9.4.3 Control of idle/inactive UEs

The UE in RRC\_IDLE or RRC\_INACTIVE performs NR sidelink communication and/or V2X sidelink communication, if configured by the upper layers. NG-RAN may provide common sidelink configuration to the UE in RRC\_IDLE or RRC\_INACTIVE via system information for NR sidelink communication and/or V2X sidelink communication. UE receives resource pool configuration and SL-DRB configuration via *SIB12* for NR sidelink communication as specified in TS 38.331 [12], and/or resource pool configuration via *SIB13* and *SIB14* for V2X sidelink communication as specified in TS 38.331 [12].

When the UE performs cell reselection, the UE interested in V2X service(s) considers at least whether NR sidelink communication and/or V2X sidelink communication are supported by the cell. The UE may consider the following carrier frequency as the highest priority frequency, except for the carrier only providing the anchor carrier:

- the frequency providing both NR sidelink communication and V2X sidelink communication, if configured to perform both NR sidelink communication and V2X sidelink communication;

- the frequency providing NR sidelink communication, if configured to perform only NR sidelink communication.

END OF THE CHANGE