**3GPP TSG-RAN WG2 Meeting #125 R2-2402039**

**Athens, Greece, 26 February – 01 March, 2024 (was R2-2401636)**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.300** | **CR** | **0785** | **rev** | **2** | **Current version:** | **18.0.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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 | **X** | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Introduction of NR sidelink relay enhancements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | LG Electronics (Rapporteur) | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_SL\_relay\_enh-Core | | | | |  | ***Date:*** | | | 2024-03-02 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | ***F*** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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 can be 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Followings are the reasons for change:  1. In the sub-clause of 16.12.1, MP Relay UE also uses Uu Relay RLC channel.  2. In the sub-clause 16.12.1, simplify the wording  3. In the sub-clause 16.12.1, redundant reference to 23.304 for UE operation already found in the previous paragraph.  4. In the sub-clause 16.12.1, missing whether the U2U Remote UE and U2U Relay UE can be in the same cells.  5. In the sub-clause 16.12.1, it is not specified how two remote UEs communicate each other.  6. In the sub-clause 16.12.2, missing that e2e DRB and e2e SRB cannot be multiplexed to the same RLC channel at the L2 U2U Relay UE and L2 U2U Remote UE.  7. In the sub-clause 16.12.2, ambiguity of how to SRAP sublayer makes mapping the received PDCP packet to the correct PDCP entity.  8. In the sub-clause 16.12.3, missing DCA notation in description of discovery.  9. In the sub-clause 16.12.3, ambiguity of which Relay/Remote UE use pre-configuration.  10. In the sub-clause 16.12.3, ambiguity of resource pool for what.  11. In the sub-clause 16.12.4, ambiguity of using different threshold of SD-RSRP and SL-RSRP for discovery message.  12. In the sub-clause 16.12.4, misplaced “to respond” in the action on which UEs to consider upon receiving a DCR message.  13. In the sub-clause 16.12.6.2, when describing switching from indirect to direct path, a description of RRC\_IDLE behaviour is put in between RRC\_CONNECTED behaviour, which may be confusing when looking at the proceeding flowchart.  14. In the sub-clause 16.12.6.2, ambiguity that the one cell belonging to the candidate relay UEs is belonging which gNB.  15. In step 1 of Figure 16.12.6.3-1, ambiguity that which information should be reported.  16. In the sub-clause 16.12.6.3, when describing switching from indirect to indirect path, a description of RRC\_IDLE behaviour is put in between RRC\_CONNECTED behaviour, which may be confusing when looking at the proceeding flowchart.  17. In step1 of Figure 16.12.6.3-2, incorrect to measure Uu link.  18. In the sub-clause 16.12.7, missing the peer U2U Remote UE when introducing U2U connection establishment procedure.  19. In step 8 of Figure 16.12.7-1, missing that integrity protection performs by using e2e bearer IDs.  20. In the sub-clause 16.21.2.1, not needed to be included the stage 3 related description.  21. In the sub-clause 16.21.2.2, redundant description that L2 MP Remote UE and L2 MP Relay UE connected via N3C interface.  22. In the sub-clause 16.21.2.2, ambiguity how the PDCP PDU is delivered to the Uu-RLC entity.  23. In the sub-clause 16.21.2.2, incorrect description using Uu Relay RLC channel for the L2 MP Relay UE’s local traffic.  24. In the sub-clause 16.21.3.1, due to ASN.1 issue, the MCG is only configured on the direct path.  25. In step 3 of Figure 16.21.3.1-1, not clear whether the RRC Reconfiguration message is for remote UE. It is for indirect path addition. And incorrect the arrow direction.  26. In the sub-clause 16.21.3.1, when the selected MP Relay UE is in RRC\_IDLE/INACTIVE, missing the resume procedure in the description.  27. In the sub-clause 16.21.3.1, for indirect path addition procedure, missing the word ‘initiates’.  28. For the figure 16.21.3.1-2, incorrect locating the half circle in step 7.  29. In step 4 of Figure 16.21.3.1-2, incorrect that the description includes SRB1 can be configured only indirect path.  30. In the figure 16.21.3.1-2, unclear the ordering among step 3a, 3b and 4  31. For the figure 16.21.3.1-3, align the size of the arrow in step 6b/7.  32. For Figure 16.21.3.1-4, align the size of the arrow in step 6b/7.  33. In clause 16.12.6.0, direct path or indirect path is the path type, not the path switch type. The path switch type should refer to something like inter-gNB direct-to-indirect path switching or inter-gNB indirect-to-direct path switching.  34. For service continuty enhancements for SL relay, we usually call the PCell change procedures between direct link and indirect link as path switching, not handover.  35. In step 5 of Figure 16.12.6.1-2 and step 6 of Figure 16.12.6.2-2, the new RRC configuration for the L2 U2N Remote UE is not clear.  36. Others simple rephrase and typo(s). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Explain the corresponding changes:  1. Clarified that Uu Relay RLC channel definition.  2. Removed the term “is introduced to”.  3. Removed the redundant part.  4. Added clearly that the U2U Remote UE and U2U Relay UE can be in the same cells.  5. Clarified that U2U Relay UE and each of the U2U Remote UE has a single PC5 unicast link.  6. Added that an end-to-end DRB and an end-to-end SRB can’t be multiplexed to the same PC5 Relay RLC channel.  7. Clarified that U2U Remote UE matches the received PDCP packet with the correct end-to-end PC5 Radio Bearer by using SRAP header information.  8. Added that a UE can perform discovery also through DCA with integrated discovery  9. Clarified that L3 U2N Relay UE and U2U Relay UE use pre-configuration.  10. Changed ‘communication resource pool’ to ‘the resource pool for NR sidelink communication’.  11. Changed to use different threshold value for SD-RSRP and SL-RSRP for all the discovery models including DCR with integrated discovery.  12. Clarified that U2U Remote UE consider to which received DCR message to response amongst candidate U2U Relay UE.  13. Moved description of RRC\_IDLE to the end of the section for direct to indirect path  14. Clarified the one cell should belong the target gNB.  15. Specified the concrete reported values.  16. Moved description of RRC\_IDLE to the end of the section for inderect to inderect path  17. Changed the Uu meaurements to sidelink measurements.  18. Added the peer U2U Remote UE when introducing the U2U connection establishment procedure.  19. Added e2e bearer IDs for SL-SRB and SL-DRB are used as input for integrity protection.  20. Removed specific PDCP duplication description.  21. Removed the redundant part of the N3C interface.  22. Clarified the PDCP PDU in the L2 MP Remote UE is delivered to RLC entity in the L2 MP Relay UE via N3C link based on UE implementation.  23. Corrected the Uu Relay RLC channels to logical channels.  24. Removed MCG is configured to the direct path. It’s clear in RRC spec.  25. Changed ‘RRC Reconfiguration for remote UE’ to ‘RRC Reconfiguration’. Removed the right side arrow.  26. Added resume procedure.  27. Rephrased and added ‘initiates’.  28. Moved the half dotted circle in the first step 7 to the target Relay UE line.  29. Removed the related sentence.  30. Added NOTE 4: the ordering among stem 3a, step 3b, and step 4 is up to gNB implementation.  31. Re-sided the arrow in the step 6b/7 of the figure 16.21.3.1-3.  32. Re-sided the arrow in the step 6b/7 of the figure 16.21.3.1-4.  33. In clause 16.12.6.0, the examples for path switch type is not correct.  34. The handover is not correctly used.  35. For Figure 16.12.6.1-2 and Figure 16.12.6.2-2, the new RRC configuration for the L2 U2N Remote UE is not clear.  36. Rephrase to read better and correct typo(s)  **Impact analysis**  Impacted functionality: Rel-18 sidelink relay  Inter-operability: Implementation of this CR by a Release 18 UE will not cause compatibility issues | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Unclear caption of Rel-18 relay operation | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.2, 16.12.1, 16.12.2.2, 16.12.3, 16.12.4, 16.12.6.2, 16.12.6.3, 16.12.7, 16.21.2.1, 16.21.2.2, 16.21.3.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS/TR TS38.331, TS38.321, TS38.351 | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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| *Start of change* |

## 3.1 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], in TS 36.300 [2] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

5GC 5G Core Network

5GS 5G System

5QI 5G QoS Identifier

A2X Aircraft-to-Everything

A-CSI Aperiodic CSI

AGC Automatic Gain Control

AI Artificial Intelligence

AKA Authentication and Key Agreement

AMBR Aggregate Maximum Bit Rate

AMC Adaptive Modulation and Coding

AMF Access and Mobility Management Function

AR Augmented Reality

ARP Allocation and Retention Priority

ATG Air to Ground

BA Bandwidth Adaptation

BCCH Broadcast Control Channel

BCH Broadcast Channel

BFD Beam Failure Detection

BH Backhaul

BL Bandwidth reduced Low complexity

BPSK Binary Phase Shift Keying

BRID Broadcast Remote Identification

C-RNTI Cell RNTI

CAG Closed Access Group

CAPC Channel Access Priority Class

CBRA Contention Based Random Access

CCE Control Channel Element

CD-SSB Cell Defining SSB

CFR Common Frequency Resource

CFRA Contention Free Random Access

CG Configured Grant

CHO Conditional Handover

CIoT Cellular Internet of Things

CLI Cross Link interference

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

CP Cyclic Prefix

CPA Conditional PSCell Addition

CPC Conditional PSCell Change

DAA Detect And Avoid

DAG Directed Acyclic Graph

DAPS Dual Active Protocol Stack

DFT Discrete Fourier Transform

DCI Downlink Control Information

DCP DCI with CRC scrambled by PS-RNTI

DCR Direct Communication Request

DL-AoD Downlink Angle-of-Departure

DL-SCH Downlink Shared Channel

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

DSR Delay Status Report

DTX Discontinuous Transmission

E-CID Enhanced Cell-ID (positioning method)

EC Energy Cost

EHC Ethernet Header Compression

ePWS enhancements of Public Warning System

ETWS Earthquake and Tsunami Warning System

FS Feature Set

FSA ID Frequency Selection Area Identity

G-CS-RNTI Group Configured Scheduling RNTI

G-RNTI Group RNTI

GFBR Guaranteed Flow Bit Rate

GIN Group ID for Network selection

GNSS Global Navigation Satellite System

GSO Geosynchronous Orbit

H-SFN Hyper System Frame Number

HAPS High Altitude Platform Station

HRNN Human-Readable Network Name

IAB Integrated Access and Backhaul

IFRI Intra Frequency Reselection Indication

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

L2 Layer-2

L3 Layer-3

LDPC Low Density Parity Check

LEO Low Earth Orbit

LTM L1/L2 Triggered Mobility

MBS Multicast/Broadcast Services

MCE Measurement Collection Entity

MCCH MBS Control Channel

MDBV Maximum Data Burst Volume

MEO Medium Earth Orbit

MIB Master Information Block

MICO Mobile Initiated Connection Only

MFBR Maximum Flow Bit Rate

ML Machine Learning

MMTEL Multimedia telephony

MNO Mobile Network Operator

MO-SDT Mobile Originated SDT

MP Multi-Path

MPE Maximum Permissible Exposure

MRB MBS Radio Bearer

MT Mobile Termination

MT-SDT Mobile Terminated SDT

MTCH MBS Traffic Channel

MTSI Multimedia Telephony Service for IMS

MU-MIMO Multi User MIMO

Multi-RTT Multi-Round Trip Time

MUSIM Multi-Universal Subscriber Identity Module

N3C Non-3GPP Connection

NB-IoT Narrow Band Internet of Things

NCD-SSB Non Cell Defining SSB

NCGI NR Cell Global Identifier

NCL Neighbour Cell List

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NGSO Non-Geosynchronous Orbit

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

NSAG Network Slice AS Group

NTN Non-Terrestrial Network

P-MPR Power Management Maximum Power Reduction

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDB Packet Delay Budget

PDC Propagation Delay Compensation

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PEI Paging Early Indication

PER Packet Error Rate

PH Paging Hyperframe

PLMN Public Land Mobile Network

PNI-NPN Public Network Integrated NPN

PO Paging Occasion

PQI PC5 5QI

PRACH Physical Random Access Channel

PRB Physical Resource Block

PRG Precoding Resource block Group

PRS Positioning Reference Signal

PS-RNTI Power Saving RNTI

PSDB PDU Set Delay Budget

PSER PDU Set Error Rate

PSI PDU Set Importance

PSIHI PDU Set Integrated Handling Information

PSS Primary Synchronisation Signal

PTM Point to Multipoint

PTP Point to Point

PTW Paging Time Window

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

QMC QoE Measurement Collection

QoE Quality of Experience

QPSK Quadrature Phase Shift Keying

RA Random Access

RA-RNTI Random Access RNTI

RACH Random Access Channel

RANAC RAN-based Notification Area Code

REG Resource Element Group

RIM Remote Interference Management

RLM Radio Link Monitoring

RMSI Remaining Minimum SI

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNTI Radio Network Temporary Identifier

RQA Reflective QoS Attribute

RQoS Reflective Quality of Service

RS Reference Signal

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

RTT Round Trip Time

RVQoE RAN visible QoE

SCS SubCarrier Spacing

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SDT Small Data Transmission

SD-RSRP Sidelink Discovery RSRP

SFI-RNTI Slot Format Indication RNTI

SHR Successful Handover Report

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SL-PRS Sidelink Positioning Reference Signal

SL-RSRP Sidelink RSRP

SMC Security Mode Command

SMF Session Management Function

SMTC SS/PBCH block Measurement Timing Configuration

S-NSSAI Single Network Slice Selection Assistance Information

SNPN Stand-alone Non-Public Network

SNPN ID Stand-alone Non-Public Network Identity

SPR Successful PSCell Addition/Change Report

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRAP Sidelink Relay Adaptation Protocol

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SSSG Search Space Set Group

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TB Transport Block

TCE Trace Collection Entity

TNL Transport Network Layer

TPC Transmit Power Control

TRP Transmit/Receive Point

TRS Tracking Reference Signal

U2N UE-to-Network

U2U UE-to-UE

UAV Uncrewed Aerial Vehicle

UCI Uplink Control Information

UDC Uplink Data Compression

UDM Unified Data Management

UE-Slice-MBR UE Slice Maximum Bit Rate

UL-AoA Uplink Angles of Arrival

UL-RTOA Uplink Relative Time of Arrival

UL-SCH Uplink Shared Channel

UPF User Plane Function

URLLC Ultra-Reliable and Low Latency Communications

VR Virtual Reality

V2X Vehicle-to-Everything

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

XR eXtended Reality

## 3.2 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], in TS 36.300 [2] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] and TS 36.300 [2].

**A2X communication**: A communication to support A2X services leveraging PC5 reference points. A2X services are realized by various types of A2X applications, i.e. BRID or DAA.

**Aerial UE communication:** functionality enabling Aerial UE function, as defined in 16.18.

**Air to Ground network:** An NG-RAN consisting of ground-based gNBs, which provide cell towers that send signals up to an aircraft's antenna(s) of onboard ATG terminal, with typical vertical altitude of around 10,000m and take-off/landing altitudes down to 3000m.

**BH RLC channel**: an RLC channel between two nodes, which is used to transport backhaul packets**.**

**Boundary IAB-node:** as defined in TS 38.401 [4].

**Broadcast MRB**:A radio bearer configured for MBS broadcast delivery.

**CAG Cell**:a PLMN cell broadcasting at least one Closed Access Group identity.

**CAG Member Cell**:for a UE, a CAG cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN, and for that PLMN, a CAG identifier belonging to the Allowed CAG list of the UE for that PLMN.

**CAG-only cell**: a CAG cell that is only available for normal service for CAG UEs.

**Cell-Defining SSB**: an SSB with an RMSI associated.

**Child node**: IAB-DU's and IAB-donor-DU's next hop neighbour node; the child node is also an IAB-node.

**Conditional Handover (CHO**): a handover procedure that is executed only when execution condition(s) are met.

**CORESET#0**: the control resource set for at least SIB1 scheduling, can be configured either via MIB or via dedicated RRC signalling.

**DAPS Handover**: a handover procedure that maintains the source gNB connection after reception of RRC message for handover and until releasing the source cell after successful random access to the target gNB.

**Data Burst:** A set of multiple PDUs generated and sent by the application in a short period of time, as defined in TS 23.501 [3].

**Direct Path**: a type of UE-to-Network transmission path, where data is transmitted between a UE and the network without sidelink relaying.

**Downstream**: direction toward child node or UE in IAB-topology.

**Early Data Forwarding**: data forwarding that is initiated before the UE executes the handover.

**Earth-centered, earth-fixed**: a global geodetic reference system for the Earth intended for practical applications of mapping, charting, geopositioning and navigation, as specified in NIMA TR 8350.2 [51].

**eRedCap UE**: a UE with enhanced reduced capabilities as specified in clause 4.2.22.1 in TS 38.306 [11].

**Feeder link**: wireless link between the NTN Gateway and the NTN payload.

**Geosynchronous Orbit**: earth-centered orbit at approximately 35786 kilometres above Earth's surface and synchronised with Earth's rotation. A geostationary orbit is a non-inclined geosynchronous orbit, i.e. in the Earth's equator plane.

**Group ID for Network Selection**: an identifier used during SNPN selection to enhance the likelihood of selecting a preferred SNPN that supports a Default Credentials Server or a Credentials Holder, as specified in TS 23.501 [3].

**gNB**: node providing NR user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**High Altitude Platform Station**: airborne vehicle embarking the NTN payload placed at an altitude between 8 and 50 km.

**IAB-donor**:gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-donor-CU**: as defined in TS 38.401 [4].

**IAB-donor-DU**:as defined in TS 38.401 [4].

**IAB-DU**: gNB-DU functionality supported by the IAB-node to terminate the NR access interface to UEs and next-hop IAB-nodes, and to terminate the F1 protocol to the gNB-CU functionality, as defined in TS 38.401 [4], on the IAB-donor.

**IAB-MT**: IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise. IAB-MT function used in 38-series of 3GPP Specifications corresponds to IAB-UE function defined in TS 23.501 [3].

**IAB-node**: RAN node that supports NR access links to UEs and NR backhaul links to parent nodes and child nodes. The IAB-node does not support backhauling via LTE.

**IAB topology**: the unison of all IAB-nodes and IAB-donor-DUs whose F1 and/or RRC connections are terminated at the same IAB-donor-CU.

**Indirect Path**: a type of UE-to-Network transmission path, where data is forwarded via a U2N Relay UE between a U2N Remote UE and the network.

**Inter-donor partial migration:** migration of an IAB-MT to a parent node underneath a different IAB-donor-CU while the collocated IAB-DU and its descendant IAB-node(s), if any, are terminated at the initial IAB-donor-CU. The procedure renders the said IAB-node as a boundary IAB-node.

**Intra-system Handover**:handover that does not involve a CN change (EPC or 5GC).

**Inter-system Handover**:handover that involves a CN change (EPC or 5GC).

**Late Data Forwarding**: data forwarding that is initiated after the source NG-RAN node knows that the UE has successfully accessed a target NG-RAN node.

**L1/L2 Triggered Mobility**: a cell switch procedure that the network triggers via MAC CE based on L1 measurements.

**Mapped Cell ID**: in NTN, it corresponds to a fixed geographical area.

**MBS Radio Bearer**: A radio bearer configured for MBS delivery.

**Mobile-IAB cell**: a cell of a mobile IAB-DU.

**Mobile IAB-DU**: gNB-DU functionality supported by the mobile IAB-node to terminate the NR access interface to UEs, and to terminate the F1 protocol to the gNB-CU functionality on the IAB-donor, as defined in TS 38.401 [4].

**Mobile IAB-DU migration**: procedure for a mobile IAB-node as defined in TS 38.401 [4].

**Mobile IAB-MT**: mobile IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise.

**Mobile IAB-MT migration**: procedure for a mobile IAB-MT as defined in TS 38.401 [4].

**Mobile IAB-node**: RAN node that supports NR access links to UEs and an NR backhaul link to a parent node, and that can conduct physical mobility across the RAN area. The mobile IAB-node function used in 38-series of 3GPP Specifications corresponds to the MBSR function defined in TS 23.501 [3].

**MP Relay UE**: a UE that provides functionality to support connectivity to the network for MP Remote UE(s).

**MP Remote UE**: a UE that communicates with the network via a direct Uu link and a MP Relay UE.

**MSG1**: preamble transmission of the random access procedure for 4-step random access (RA) type.

**MSG3**: first scheduled transmission of the random access procedure.

**MSGA**:preamble and payload transmissions of the random access procedure for 2-step RA type.

**MSGB**:response to MSGA in the 2-step random access procedure. MSGB may consist of response(s) for contention resolution, fallback indication(s), and backoff indication.

**Multicast/Broadcast Service**: A point-to-multipoint service as defined in TS 23.247 [45].

**Multicast MRB**:A radio bearer configured for MBS multicast delivery.

**Multi-hop backhauling**: using a chain of NR backhaul links between an IAB-node and an IAB-donor.

**NCR-Fwd**: Network-Controlled Repeater node function, which performs amplifying-and-forwarding of UL/DL RF signals between gNB and UE. The behaviour of the NCR-Fwd is controlled according to the side control information received by the NCR-MT from a gNB.

**NCR-Fwd access link**: link used for transmissions between the NCR-Fwd and UEs.

**NCR-Fwd backhaul link**: link used for backhauling between the NCR-Fwd and gNB.

**NCR-MT**: NCR-node entity which communicates with a gNB via a control link to receive side control information. The control link is based on NR Uu interface.

**NCR-node**: RAN node comprising NCR-MT and NCR-Fwd.

**ng-eNB**: node providing E-UTRA user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**NG-C**: control plane interface between NG-RAN and 5GC.

**NG-U**: user plane interface between NG-RAN and 5GC.

**NG-RAN node**: either a gNB or an ng-eNB.

**Non-CAG Cell**: a PLMN cell which does not broadcast any Closed Access Group identity.

**Non-Cell Defining SSB**: an SSB without an RMSI associated.

**Non-Geosynchronous orbit**: earth-centered orbit with an orbital period that does not match Earth's rotation on its axis. This includes Low and Medium Earth Orbit (LEO and MEO). LEO operates at altitudes between 300 km and 1500 km and MEO at altitudes between 7000 km and 25000 km, approximately.

**Non-terrestrial network**: an NG-RAN consisting of gNBs, which provide non-terrestrial NR access to UEs by means of an NTN payload embarked on an airborne or space-borne NTN vehicle and an NTN Gateway.

**NR backhaul link**: NR link used for backhauling between an IAB-node and an IAB-donor, and between IAB-nodes in case of a multi-hop backhauling.

**NR sidelink communication**: AS functionality enabling at least V2X communication as defined in TS 23.287 [40] and the ProSe communication (including ProSe non-Relay and UE-to-Network Relay communication) as defined in TS 23.304 [48], between two or more nearby UEs, using NR technology but not traversing any network node.

**NR sidelink discovery**: AS functionality enabling ProSe non-Relay Discovery and ProSe UE-to-Network Relay discovery for Proximity based Services as defined in TS 23.304 [48] between two or more nearby UEs, using NR technology but not traversing any network node.

**NTN Gateway**: an earth station located at the surface of the earth, providing connectivity to the NTN payload using the feeder link. An NTN Gateway is a TNL node.

**NTN payload**: a network node, embarked on board a satellite or high altitude platform station, providing connectivity functions, between the service link and the feeder link. In the current version of this specification, the NTN payload is a TNL node.

**Numerology**: corresponds to one subcarrier spacing in the frequency domain. By scaling a reference subcarrier spacing by an integer *N*, different numerologies can be defined.

**Parent node**: IAB-MT's next hop neighbour node; the parent node can be IAB-node or IAB-donor-DU

**PC5 Relay RLC channel**: an RLC channel between L2 U2N Remote UE and L2 U2N Relay UE, or between L2 U2U Remote UE and L2 U2U Relay UE, which is used to transport packets over PC5 for L2 UE-to-Network/UE-to-UE Relay**.**

**PDU Set**: one or more PDUs carrying the payload of one unit of information generated at the application level (e.g. frame(s) or video slice(s) for XR Services), as defined in TS 23.501 [3].

**PLMN Cell**: a cell of the PLMN.

**RACH-less LTM**: an LTM cell switch procedure where UE skips the random access procedure.

**RedCap UE**: a UE with reduced capabilities as specified in clause 4.2.21.1 in TS 38.306 [11].

**Relay discovery**: AS functionality enabling 5G ProSe UE-to-Network Relay Discovery as defined in TS 23.304 [48], using NR technology but not traversing any network node.

**Satellite**:a space-borne vehicle orbiting the Earth embarking the NTN payload.

**Service link**:wireless link between the NTN payload and UE.

**Sidelink Discovery RSRP:** RSRP measurements on PC5 link related to NR sidelink discovery.

**Sidelink RSRP:** RSRP measurements on PC5 link related to NR sidelink communication.

**SNPN Access Mode**: mode of operation whereby a UE only accesses SNPNs.

**SNPN-only cell**: a cell that is only available for normal service for SNPN subscribers.

**SNPN Identity**: the identity of Stand-alone NPN defined by the pair (PLMN ID, NID).

**Subsequent LTM**: LTM cell switch procedures between candidate cells without RRC reconfiguration by the network in between.

**Transmit/Receive Point**:part of the gNB transmitting and receiving radio signals to/from UE according to physical layer properties and parameters inherent to that element.

**U2N Relay UE**: a UE that provides functionality to support connectivity to the network for U2N Remote UE(s).

**U2N Remote UE**: a UE that communicates with the network via a U2N Relay UE.

**U2U Relay UE**: a UE that provides functionality to support connectivity between two U2U Remote UEs.

**U2U Remote UE**: a UE that communicates with other UE(s) via a U2U Relay UE.

**Upstream**: direction toward parent node in IAB-topology.

**Uu Relay RLC channel**: an RLC channel between L2 U2N Relay UE or MP Relay UE and gNB, which is used to transport packets over Uu for L2 UE-to-Network Relay or for indirect path in case of MP**.**

**V2X sidelink communication**: AS functionality enabling V2X communication as defined in TS 23.285 [41], between nearby UEs, using E-UTRA technology but not traversing any network node.

**Xn**: network interface between NG-RAN nodes.

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## 16.12 Sidelink Relay

### 16.12.1 General

Sidelink relay supports 5G ProSe UE-to-Network Relay (U2N Relay) function (specified in TS 23.304 [48]) to provide connectivity to the network for U2N Remote UE(s). Both L2 and L3 U2N Relay architectures are supported. The L3 U2N Relay architecture is transparent to the serving NG-RAN of the U2N Relay UE, except for controlling sidelink resources. The detailed architecture and procedures for L3 U2N Relay can be found in TS 23.304 [48].

A U2N Relay UE shall be in RRC\_CONNECTED to perform relaying of unicast data.

For L2 U2N Relay operation, the following RRC state combinations are supported:

- Both L2 U2N Relay UE and L2 U2N Remote UE shall be in RRC\_CONNECTED to perform transmission/reception of relayed unicast data; and

- The L2 U2N Relay UE can be in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED as long as all the L2 U2N Remote UE(s) that are connected to the L2 U2N Relay UE are either in RRC\_INACTIVE or in RRC\_IDLE.

A single unicast link is established between one L2 U2N Relay UE and one L2 U2N Remote UE. The traffic to the NG-RAN of L2 U2N Remote UE via a given L2 U2N Relay UE and the traffic of the L2 U2N Relay UE shall be separated in different Uu RLC channels.

For L2 U2N Relay, the L2 U2N Remote UE can only be configured to use resource allocation mode 2 (as specified in 5.7.2 and 16.9.3.1) for data to be relayed.

Sidelink relay additionally supports 5G ProSe UE-to-UE Relay (U2U Relay) function (specified in TS 23.304 [48]) to provide connectivity between U2U Remote UEs. Both L2 and L3 U2U Relay architectures are supported. The L3 U2U Relay architecture is transparent to the AS layer of the U2U Relay UE. The detailed architecture and procedures for L3 U2U Relay can be found in TS 23.304 [48].

A U2U Relay UE is used to provide coverage extension of the sidelink transmissions between two U2U Remote UEs. For the coverage extension, the U2U Remote UE can communicate with a peer U2U Remote UE(s), which are not reachable within the sidelink coverage, via the U2U Relay UE.

The U2U Relay UE and U2U Remote UE can be in any RRC state. The U2U Relay UE and the U2U Remote UEs can be in the coverage of the same or different cells or out-of-coverage. Both sidelink resource allocation modes, i.e., mode 1 and mode 2 are supported for the U2U Relay UE and U2U Remote UEs. For U2U Relay, a single PC5 unicast link is established between U2U Relay UE and each of the U2U Remote UEs. After PC5 unicast link establishment between U2U Relay UE and U2U Remote UEs, end-to-end PC5 unicast link connection establishment is performed between U2U Remote UEs. Only unicast is supported between U2U Relay UE and U2U Remote UEs.

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#### 16.12.2.2 L2 UE-to-UE Relay

The protocol stacks for the user plane and the control plane of the L2 U2U Relay architecture are illustrated in Figure 16.12.2.2-1 and Figure 16.12.2.2-2. The SRAP sublayer is placed above the RLC sublayer for both CP and UP at both PC5 interfaces. The sidelink SDAP, PDCP and RRC are terminated between two L2 U2U Remote UEs (i.e., end-to-end), while SRAP, RLC, MAC and PHY are terminated in each hop of PC5 link.



Figure 16.12.2.2-1: User plane protocol stack for L2 UE-to-UE Relay



Figure 16.12.2.2-2: Control plane protocol stack for L2 UE-to-UE Relay

For L2 UE-to-UE Relay, the SRAP sublayer at L2 U2U Remote UE:

- The SRAP sublayer at L2 U2U Remote UE performs bearer mapping between end-to-end PC5 Radio Bearers (SL-SRBs or SL-DRBs) of the L2 U2U Remote UE and PC5 Relay RLC Channel at each hop between the L2 U2U Remote UE and the L2 U2U Relay UE.

- For the traffic transmitted from an L2 U2U Remote UE to an L2 U2U Relay UE, the different end-to-end PC5 Radio Bearers (SL-SRBs or SL-DRBs) towards the same peer L2 U2U Remote UE and/or different peer L2 U2U Remote UEs can be multiplexed to the same PC5 Relay RLC channel between the L2 U2U Remote UE(s) and the L2 U2U Relay UE. An end-to-end DRB and an end-to-end SRB can’t be multiplexed to the same PC5 Relay RLC channel.

- For the traffic received at L2 U2U Remote UE, the same PC5 Relay RLC channel from one L2 U2U Relay UE can be de-multiplexed to the different end-to-end PC5 Radio Bearers (SL-SRBs or SL-DRBs) of the same peer L2 U2U Remote UE and/or different peer L2 U2U Remote UEs.

- The SRAP sublayer at L2 U2U Remote UE supports identification of the peer L2 U2U Remote UE and itself. The local IDs are assigned by L2 U2U Relay UE to both L2 U2U Remote UEs for identification. For the two local IDs, one of them identifies L2 U2U Remote UE and the other identifies the peer L2 U2U Remote UE. The local ID of the peer L2 U2U Remote UE and the local ID of L2 U2U Remote UE are delivered by L2 U2U Relay UE to the L2 U2U Remote UEs along with the corresponding L2 ID of the peer L2 U2U Remote UE. The SRAP header includes the identity information of the end-to-end PC5 Radio Bearer and two local IDs. The peer L2 U2U Remote UE matches the received packets with the specific sidelink PDCP entity with the correct end-to-end PC5 Radio Bearer of the L2 U2U Remote UEs.

For L2 UE-to-UE Relay, the SRAP sublayer at L2 U2U Relay UE:

- The SRAP sublayer at L2 U2U Relay UE determines the egress PC5 Relay RLC Channel based on the mapping of the end-to-end PC5 Radio Bearer and egress PC5 Relay RLC Channel for a particular pair of L2 U2U Remote UE and the peer L2 U2U Remote UE.

- For the ingress traffic received from an/multiple L2 U2U Remote UE(s) at L2 U2U Relay UE, the different end-to-end PC5 Radio Bearers (SL-SRBs or SL-DRBs) of the same L2 U2U Remote UE and/or the same/different end-to-end PC5 Radio Bearers (SL-SRBs or SL-DRBs) of L2 U2U Remote UEs can be multiplexed to the same egress PC5 Relay RLC channel in between the L2 U2U Relay UE and the peer L2 U2U Remote UE. An end-to-end DRB and an end-to-end SRB can’t be multiplexed to the same PC5 Relay RLC channel.

### 16.12.3 Relay Discovery

Model A and Model B discovery models as defined in TS 23.304 [48] are supported for U2N/U2U Relay discovery. The protocol stack used for discovery is illustrated in Figure 16.12.3-1.



Figure 16.12.3-1: Protocol Stack of Discovery Message for UE-to-Network/UE-to-UE Relay

The U2N Remote UE can perform Relay discovery message (i.e., as specified in TS 23.304 [48]) transmission and may monitor the sidelink for Relay discovery message while in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED. The network may broadcast or configure via dedicated RRC signalling a Uu RSRP threshold, which is used by the U2N Remote UE to determine if it can transmit Relay discovery messages to U2N Relay UE(s).

The U2N Relay UE can perform Relay discovery message (i.e., as specified in TS 23.304 [48]) transmission and may monitor the sidelink for Relay discovery message while in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED. The network may broadcast or configure via dedicated RRC signalling a maximum Uu RSRP threshold, a minimum Uu RSRP threshold, or both, which are used by the U2N Relay UE to determine if it can transmit Relay discovery messages to U2N Remote UE(s).

The U2U Remote UE and U2U Relay UE can perform Relay discovery message transmission or DCR/DCA message with integrated discovery transmission and may monitor for Relay discovery message or DCR/DCA message with integrated discovery while in coverage (i.e. RRC\_IDLE, RRC\_INACTIVE, or RRC\_CONNECTED) or out-of-coverage.

The network may provide the Relay discovery configuration using broadcast or dedicated signalling. In addition, the U2N/U2U Remote UE, L3 U2N Relay UE and U2U Relay UE may use pre-configuration for Relay discovery.

The resource pool(s) used for NR sidelink communication can be used for Relay discovery or the network may configure resource pool(s) dedicated for Relay discovery. Resource pool(s) dedicated for Relay discovery can be configured simultaneously with resource pool(s) for NR sidelink communication in system information, dedicated signalling and/or pre-configuration. Whether dedicated resource pool(s) for Relay discovery are configured is based on network implementation. If resource pool(s) dedicated for Relay discovery are configured, only those resource pool(s) dedicated for Relay discovery shall be used for Relay discovery. If only resource pool(s) for NR sidelink communication are configured, all the configured resource pool(s) can be used for Relay discovery and NR sidelink communication. Only the resource pool for NR sidelink communication is used for the DCR/DCA message with integrated discovery.

For U2N Remote UE (including both in-coverage and out of coverage cases) that has been connected to the network via a U2N Relay UE, only resource allocation mode 2 is used for Relay discovery message transmission.

For in-coverage U2N Relay UE, and for both in-coverage and out of coverage U2N Remote UEs, NR sidelink resource allocation principles are applied for Relay discovery message transmission.

For U2U Remote UE and U2U Relay UE, NR sidelink resource allocation principles, both mode 1 and mode 2, can be applied for Relay discovery message transmission.

The sidelink power control for the transmission of Relay discovery messages is same as for NR sidelink communication.

No ciphering or integrity protection in PDCP layer is applied for the Relay discovery messages.

The U2N/U2U Remote UE and U2N/U2U Relay UE can determine from SIB12 whether the gNB supports Relay discovery, or Non-Relay discovery, or both.

### 16.12.4 Relay Selection/Reselection

The U2N Remote UE performs radio measurements at PC5 interface and uses them for U2N Relay selection and reselection along with higher layer criteria, as specified in TS 23.304 [48]. When there is no unicast PC5 connection between the U2N Relay UE and the U2N Remote UE, the U2N Remote UE uses SD-RSRP measurements to evaluate whether PC5 link quality towards a U2N Relay UE satisfies relay selection criterion.

For relay reselection, U2N Remote UE uses SL-RSRP measurements towards the serving U2N Relay UE for relay reselection trigger evaluation when there is data transmission from U2N Relay UE to U2N Remote UE, and it is left to UE implementation whether to use SL-RSRP or SD-RSRP for relay reselection trigger evaluation in case of no data transmission from U2N Relay UE to U2N Remote UE.

A U2N Relay UE is considered suitable by a U2N Remote UE in terms of radio criteria if the PC5 link quality measured by U2N Remote UE towards the U2N Relay UE exceeds configured threshold (pre-configured or provided by gNB). The U2N Remote UE searches for suitable U2N Relay UE candidates that meet all AS layer and higher layer criteria (see TS 23.304 [48]). If there are multiple such suitable U2N Relay UEs, it is up to U2N Remote UE implementation to choose one U2N Relay UE among them. For L2 U2N Relay (re)selection, the PLMN ID and cell ID can be used as additional AS criteria.

The U2N Remote UE triggers U2N Relay selection in following cases:

- Direct Uu signal strength of current serving cell of the U2N Remote UE is below a configured signal strength threshold;

- Indicated by upper layer of the U2N Remote UE.

The U2N Remote UE may trigger U2N Relay reselection in following cases:

- PC5 signal strength of current U2N Relay UE is below a (pre)configured signal strength threshold;

- Cell reselection, handover, Uu RLF, or Uu RRC connection establishment/resume failure has been indicated by U2N Relay UE via PC5-RRC signalling;

- When U2N Remote UE receives a PC5-S link release message from U2N Relay UE;

- When U2N Remote UE detects PC5 RLF;

- Indicated by upper layer.

For L2 U2N Remote UEs in RRC\_IDLE or RRC\_INACTIVE and L3 U2N Remote UEs, the cell (re)selection procedure and relay (re)selection procedure run independently. If both suitable cells and suitable U2N Relay UEs are available, it is up to the U2N Remote UE implementation to select either a cell or a U2N Relay UE. A L3 U2N Remote UE may select a cell and a L3 U2N Relay UE simultaneously and this is up to implementation of L3 U2N Remote UE.

For both L2 and L3 U2N Relay UEs in RRC\_IDLE or RRC\_INACTIVE, the PC5-RRC message(s) are used to inform their connected U2N Remote UE(s) when U2N Relay UEs select a new cell. The PC5-RRC message(s) are also used to inform their connected L2 or L3 U2N Remote UE(s) when L2 or L3 U2N Relay UE performs handover, detects Uu RLF, or its Uu RRC connection establishment/resume fails. Upon reception of the PC5 RRC message for notification, it is up to U2N Remote UE implementation whether to release or keep the unicast PC5 link. If U2N Remote UE decides to release the unicast PC5 link, it triggers the PC5 release procedure and may perform cell or relay reselection.

The U2U Remote UE performs radio measurements (i.e., SD-RSRP and/or SL-RSRP) at PC5 interface and uses them for U2U Relay selection and reselection along with higher layer criteria, as specified in TS 23.304 [48].

For relay selection, U2U Remote UE uses SL-RSRP measurements towards the peer U2U Remote UE for relay selection trigger evaluation when valid SL-RSRP measurements are available. For relay reselection, U2U Remote UE uses SL-RSRP measurement towards the U2U Relay UE for relay reselection trigger evaluation when there is data transmission from U2U Relay UE to U2U Remote UE. It is left to U2U Remote UE implementation whether to use SL-RSRP or SD-RSRP for relay selection or reselection trigger evaluation in case of no data transmission. The thresholds for SD-RSRP and SL-RSRP can be configured separately for the trigger evaluation of U2U relay selection or reselection. The same value(s) of the SD-RSRP and SL-RSRP thresholds, which is used for relay selection or reselection, are applied for all the discovery models including DCR with integrated discovery.

The U2U Remote UE may trigger U2U Relay selection in the following cases:

- When the SL-RSRP or SD-RSRP between U2U Remote UEs is below a (pre)configured signal strength threshold;

- When U2U Remote UE receives an indication to trigger U2U relay selection from the upper layer of the UE.

The U2U Remote UE may trigger U2U Relay reselection in the following cases:

- When the SL-RSRP or SD-RSRP of the current U2U Relay UE is below a (pre)configured signal strength threshold;

- When U2U Remote UE receives an indication from the upper layer due to detecting PC5 RLF;

- When L2 U2U Remote UE receives an indication from the upper layer due to receiving the PC5 RLF indication from the L2 U2U Relay UE;

- When U2U Remote UE receives a PC5-S link release message from U2U Relay UE;

- When U2U Remote UE receives an indication to trigger U2U relay reselection from the upper layer of the UE.

For the discovery model A, the U2U Relay UE should announce via discovery announcement message only the neighbour U2U Remote UE(s) for which the SD-RSRP/SL-RSRP between the U2U Relay and the neighbour U2U Remote UE(s) is above a configured threshold. Upon discovery message reception, U2U Remote UE considers a U2U Relay UE as a candidate U2U Relay UE if the SD-RSRP towards the U2U Relay UE is above a configured threshold and the upper layer criteria are met.

For the discovery model B, when the U2U Relay UE receives the discovery solicitation message from U2U Remote UE, the U2U Relay UE forwards the discovery solicitation message only if the SD-RSRP between the U2U Relay UE and the U2U Remote UE is above a threshold. After the peer U2U remote UE receives a discovery solicitation message from the U2U Relay UE, the peer U2U Remote UE transmits the discovery response message only if the SD-RSRP between the peer U2U Remote UE and the U2U Relay UE is above a configured threshold. Upon discovery response message reception forwarded by the U2U Relay UE, the U2U Remote UE considers a U2U Relay UE as a candidate U2U Relay UE if the SD-RSRP towards the U2U Relay UE is above a configured threshold and the upper layer criteria are met.

For the DCR message with integrated discovery, when the U2U Relay UE receives the DCR message with integrated discovery from U2U Remote UE, the U2U Relay UE forwards the DCR message with integrated discovery only if the SL-RSRP between the U2U Relay UE and the U2U Remote UE is above a threshold. Upon receiving DCR message with integrated discovery from one or multiple U2U Relay UEs, the peer U2U Remote UE should consider to which received DCR message to respond amongst candidate U2U Relay UEs towards which the SL-RSRP is above a configured SD-RSRP threshold (not the SL-RSRP, as broadcast is used) and that satisfy upper-layer criteria, and select a U2U Relay UE among them.

### 16.12.5 Control plane procedures for L2 U2N Relay

#### 16.12.5.1 RRC Connection Management

The L2 U2N Remote UE needs to establish its own PDU sessions/DRBs with the network before user plane data transmission.

The NR sidelink PC5 unicast link establishment procedures can be used to setup a secure unicast link between L2 U2N Remote UE and L2 U2N Relay UE before L2 U2N Remote UE establishes a Uu RRC connection with the network via L2 U2N Relay UE.

The establishment of Uu SRB1/SRB2 and DRB of the L2 U2N Remote UE is subject to Uu configuration procedures for L2 UE-to-Network Relay.

The following high level connection establishment procedure in Figure 16.12.5.1-1 applies to a L2 U2N Relay and L2 U2N Remote UE:



Figure 16.12.5.1-1: Procedure for L2 U2N Remote UE connection establishment

1. The L2 U2N Remote and L2 U2N Relay UE perform discovery procedure, and establish a PC5-RRC connection using the NR sidelink PC5 unicast link establishment procedure.

2. The L2 U2N Remote UE sends the first RRC message (i.e., *RRCSetupRequest*) for its connection establishment with gNB via the L2 U2N Relay UE, using a specified PC5 Relay RLC channel configuration. The L2 U2N Relay UE sends the *SidelinkUEInformationNR* message to request for the dedicated configurations required to support the relay operation for the L2 U2N Remote UE. If the L2 U2N Relay UE is not in RRC\_CONNECTED, it needs to do its own Uu RRC connection establishment upon reception of a message on the specified PC5 Relay RLC channel. After L2 U2N Relay UE's RRC connection establishment procedure and sending the *SidelinkUEInformationNR* message, gNB configures SRB0 relaying Uu Relay RLC channel to the U2N Relay UE. The gNB responds with an *RRCSetup* message to L2 U2N Remote UE. The *RRCSetup* message is sent to the L2 U2N Remote UE using SRB0 relaying Uu Relay RLC channel over Uu and a specified PC5 Relay RLC channel over PC5.

NOTE 1: Void.

3. The gNB and L2 U2N Relay UE perform relaying channel setup procedure over Uu. According to the configuration from gNB, the L2 U2N Relay/Remote UE establishes a PC5 Relay RLC channel for relaying of SRB1 towards the L2 U2N Remote/Relay UE over PC5.

4. The *RRCSetupComplete* message is sent by the L2 U2N Remote UE to the gNB via the L2 U2N Relay UE using SRB1 relaying channel over PC5 and SRB1 relaying channel configured to the L2 U2N Relay UE over Uu. Then the L2 U2N Remote UE is as in RRC\_CONNECTED with the gNB.

5. The L2 U2N Remote UE and gNB establish security following the Uu security mode procedure and the security messages are forwarded through the L2 U2N Relay UE.

6. The gNB sends an *RRCReconfiguration* message to the L2 U2N Remote UE via the L2 U2N Relay UE, to setup the end-to-end SRB2/DRBs of the L2 U2N Remote UE. The L2 U2N Remote UE sends an *RRCReconfigurationComplete* message to the gNB via the L2 U2N Relay UE as a response. In addition, the gNB may configure additional Uu Relay RLC channels between the gNB and L2 U2N Relay UE, and PC5 Relay RLC channels between L2 U2N Relay UE and L2 U2N Remote UE for the relaying traffic.

#### 16.12.5.2 Radio Link Failure

The L2 U2N Remote UE in RRC\_CONNECTED suspends Uu RLM (as described in clause 9.2.7) when connected to the gNB via a L2 U2N Relay UE.

The L2 U2N Relay UE declares Uu Radio Link Failure (RLF) following the same criteria as described in clause 9.2.7.

After Uu RLF is declared, the L2 U2N Relay UE takes the following action on top of the actions described in clause 9.2.7:

- a PC5-RRC message can be used for sending an indication to its connected L2 U2N Remote UE(s), which may trigger RRC connection re-establishment for L2 U2N Remote UE; or

- indicating to upper layer to trigger PC5 unicast link release.

Upon detecting PC5 RLF, the L2 U2N Remote UE may trigger RRC connection re-establishment.

#### 16.12.5.3 RRC Connection Re-establishment

The L2 U2N Remote UE may perform the following actions during the RRC connection re-establishment procedure:

- If only suitable cell(s) are available, the L2 U2N Remote UE initiates RRC re-establishment procedure towards a suitable cell;

- If only suitable L2 U2N Relay UE(s) are available, the L2 U2N Remote UE initiates RRC re-establishment procedure towards a suitable relay UE's serving cell via selected suitable L2 U2N Relay;

- If both a suitable cell and a suitable relay are available, the L2 U2N Remote UE can select either one to initiate RRC re-establishment procedure based on implementation.

#### 16.12.5.4 RRC Connection Resume

The RRC connection resume procedure described in clause 9.2.2 is applied to L2 U2N Remote UE.

#### 16.12.5.5 System Information

The in-coverage L2 U2N Remote UE is allowed to acquire any necessary SIB(s) over Uu interface irrespective of its PC5 connection to L2 U2N Relay UE. The L2 U2N Remote UE can also receive the system information from the L2 U2N Relay UE after PC5 connection establishment with L2 U2N Relay UE.

The L2 U2N Remote UE in RRC\_CONNECTED can use the on-demand SIB framework as specified in TS 38.331 [12] to request the SIB(s) via L2 U2N Relay UE. The L2 U2N Remote UE in RRC\_IDLE or RRC\_INACTIVE can inform L2 U2N Relay UE of its requested SIB type(s) via PC5-RRC message. Then, L2 U2N Relay UE triggers on-demand SI/SIB acquisition procedure as specified in TS 38.331 [12] according to its own RRC state (if needed) and sends the acquired SI(s)/SIB(s) to L2 U2N Remote UE via PC5-RRC message.

Any SIB that the RRC\_IDLE or RRC\_INACTIVE L2 U2N Remote UE has a requirement to use (e.g., for relay purpose) can be requested by the L2 U2N Remote UE (from the L2 U2N Relay UE or the network). For SIBs that have been requested by the L2 U2N Remote UE from the L2 U2N Relay UE, the L2 U2N Relay UE forwards them again in case of any update for requested SIB(s). In case of RRC\_CONNECTED L2 U2N Remote UE(s), it is the responsibility of the network to send updated SIB(s) to L2 U2N Remote UE(s) when they are updated. The L2 U2N Remote UE de-configures SI request with L2 U2N Relay UE when entering into RRC\_CONNECTED state.

For SIB1 forwarding, for L2 U2N Remote UE, both request-based delivery (i.e., SIB1 request by the U2N Remote UE) and unsolicited forwarding are supported by L2 U2N Relay UE, of which the usage is left to L2 U2N Relay UE implementation. If SIB1 changes, for L2 U2N Remote UE in RRC\_IDLE or RRC\_INACTIVE, the L2 U2N Relay UE always forwards SIB1.

For the L2 U2N Remote UE in RRC\_IDLE or RRC\_INACTIVE, the short message over Uu interface is not forwarded by the L2 U2N Relay UE to the L2 U2N Remote UE. The L2 U2N Relay UE can forward PWS SIBs to its connected L2 U2N Remote UE(s).

RAN sharing is supported for L2 U2N Relay UE. In particular, the L2 U2N Relay UE may forward, via discovery message, cell access related information before the establishment of a PC5-RRC connection.

#### 16.12.5.6 Paging

When both L2 U2N Relay UE and L2 U2N Remote UE are in RRC IDLE or RRC INACTIVE, the L2 U2N Relay UE monitors paging occasions of its connected L2 U2N Remote UE(s). When a L2 U2N Relay UE needs to monitor paging for a L2 U2N Remote UE, the L2 U2N Relay UE should monitor all POs of the L2 U2N Remote UE.

When L2 U2N Relay UE is in RRC\_CONNECTED and L2 U2N Remote UE(s) is in RRC\_IDLE or RRC\_INACTIVE, there are two options for paging delivery:

- The L2 U2N Relay UE monitors POs of its connected L2 U2N Remote UE(s) if the active DL BWP of the L2 U2N Relay UE is configured with common search space including paging search space;

- The delivery of the L2 U2N Remote UE's paging can be performed through a dedicated RRC message from the gNB to the L2 U2N Relay UE. The dedicated RRC message for delivering L2 U2N Remote UE paging to the RRC\_CONNECTED L2 U2N Relay UE may contain one or more Remote UE IDs (5G-S-TMSI or I-RNTI).

It is up to network implementation to decide which of the above two options to use. The L2 U2N Relay UE in RRC\_CONNECTED, if configured with paging search space, can determine whether to monitor POs for a L2 U2N Remote UE based on the indication within the PC5-RRC signalling received from the L2 U2N Remote UE.

The L2 U2N Remote UE in RRC\_IDLE provides 5G-S-TMSI and UE specific DRX cycle (if configured by upper layer) to the L2 U2N Relay UE for requesting to perform PO monitoring. The L2 U2N Remote UE in RRC\_INACTIVE provides the minimum value of two UE specific DRX cycles (if configured respectively by upper layer and NG-RAN), 5G-S-TMSI and I-RNTI to the L2 U2N Relay UE for PO monitoring. The L2 U2N Relay UE in RRC\_CONNECTED can notify the L2 U2N Remote UE information (i.e. 5G-S-TMSI/I-RNTI) to the gNB via the *SidelinkUEInformationNR* message for paging delivery purpose. The L2 U2N Relay UE receives paging messages to check the 5G-S-TMSI/I-RNTI and sends relevant paging record to the L2 U2N Remote UE accordingly.

The L2 U2N Relay UE uses unicast signalling to send paging to the L2 U2N Remote UE via PC5.

#### 16.12.5.7 Access Control

The L2 U2N Remote UE performs unified access control as defined in TS 38.331 [12]. The L2 U2N Relay UE does not perform UAC for L2 U2N Remote UE's data.

#### 16.12.5.8 Mobility Registration Update and RAN Area Update

The L2 U2N Remote UE performs Mobility Registration Update/RNAU based on the L2 U2N Relay UE's serving cell when it is connected with the L2 U2N Relay UE. A L2 U2N Remote UE in RRC\_IDLE or RRC\_INACTIVE initiates Mobility Registration Update/RNAU procedure if the serving cell changes (due to cell change by the L2 U2N Relay UE) and the new serving cell is outside of the L2 U2N Remote UE's configured RNA/TA.

### 16.12.6 Service Continuity for L2 U2N relay

#### 16.12.6.0 General

The service continuity procedure is applicable for the mobility cases of path switch from indirect to direct path and from direct to indirect path when the L2 U2N Remote UE and L2 U2N Relay UE belong to the same gNB or different gNB. This procedure is also applicable for the mobility cases of path switch from indirect to indirect path when the two L2 U2N Relay UEs belong to the same gNB or different gNBs. For inter-gNB path switching, the source gNB decides to trigger path switching and the path switch type.

#### 16.12.6.1 Switching from indirect to direct path

For service continuity of L2 U2N Relay, the following procedure is used, in case of L2 U2N Remote UE switching from indirect to direct path under the same gNB:



Figure 16.12.6.1-1: Procedure for L2 U2N Remote UE intra-gNB switching from indirect to direct path

1. The Uu measurement configuration and measurement report signalling procedures are performed to evaluate both relay link measurement and Uu link measurement. The measurement results from L2 U2N Remote UE are reported when configured measurement reporting criteria are met. The sidelink relay measurement report shall include at least L2 U2N Relay UE's source L2 ID, serving cell ID (i.e., NCGI/NCI), and sidelink measurement quantity result. The sidelink measurement quantity can be SL-RSRP of the serving L2 U2N Relay UE, and if SL-RSRP is not available, SD-RSRP is used.

2. The gNB decides to switch the L2 U2N Remote UE onto direct Uu path.

3. The gNB sends the *RRCReconfiguration* message to the L2 U2N Remote UE. The L2 U2N Remote UE stops User Plane and Control Plane transmission via the L2 U2N Relay UE after reception of the *RRCReconfiguration* message with the path switch configuration.

4. The L2 U2N Remote UE synchronizes with the gNB and performs Random Access.

5. The UE (i.e., L2 U2N Remote UE in previous steps) sends the *RRCReconfigurationComplete* message to the gNB via the direct path, using the configuration provided in the *RRCReconfiguration* message. From this step, the UE (i.e., L2 U2N Remote UE in previous steps) uses the RRC connection via the direct path to the gNB.

6. The gNB sends the *RRCReconfiguration* message to the L2 U2N Relay UE to reconfigure the connection between the L2 U2N Relay UE and the gNB. The *RRCReconfiguration* message to the L2 U2N Relay UE can be sent any time after step 3 based on gNB implementation (e.g., to release Uu Relay RLC Channel and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration related to the L2 U2N Remote UE).

7. Either L2 U2N Relay UE or L2 U2N Remote UE's AS layer indicates upper layers to release PC5 unicast link after receiving the *RRCReconfiguration* message from the gNB. The timing to execute link release is up to UE implementation.

8. The data path is switched from indirect path to direct path between the UE (i.e., previous L2 U2N Remote UE) and the gNB. The PDCP re-establishment or PDCP data recovery in uplink is performed by the UE (i.e., previous L2 U2N Remote UE) for lossless delivery during path switch if gNB configures it.

NOTE 1: Step 8 can be executed any time after step 4. Step 8 is independent of step 6 and step 7.

For service continuity of L2 U2N Relay, the following procedure is used, in case of L2 U2N Remote UE switching from indirect to direct path under another gNB:



Figure 16.12.6.1-2: Procedure for L2 U2N Remote UE inter-gNB switching from indirect to direct path

1. The Uu measurement configuration is configured by the source gNB, and measurement report signalling procedures are performed by the L2 U2N Remote UE to evaluate both relay link measurement and Uu link measurement. The measurement results from L2 U2N Remote UE are reported when configured measurement reporting criteria are met. The sidelink relay measurement report shall include at least L2 U2N Relay UE's source L2 ID, serving cell ID (i.e., NCGI/NCI), and sidelink measurement quantity result. The sidelink measurement quantity can be SL-RSRP of the serving L2 U2N Relay UE, and if SL-RSRP is not available, SD-RSRP is used.

2. The source gNB decides to trigger path switch for the L2 U2N Remote UE, onto direct path.

3. The source gNB sends the HANDOVER REQUEST message to the target gNB with necessary information to prepare the handover at the target side.

NOTE 2: In order to support the DL lossless path switch for the L2 U2N Remote UE, the source gNB may not discard the DL data even though the delivery of the data has been acknowledged by the L2 U2N Relay UE based on the gNB implementation. Then, the source gNB forwards the buffered DL data to the target gNB during the data forwarding procedure.

4. Admission Control may be performed by the target gNB.

5. The target gNB sends the HANDOVER REQUEST ACKNOWLEDGE message to the source gNB, which contains RRC configuration for the L2 U2N Remote UE at the target side.

6. The source gNB triggers the path switch by sending an *RRCReconfiguration* message to the L2 U2N Remote UE, containing at least cell ID and the information required to access the target cell. The L2 U2N Remote UE stops User Plane and Control Plane transmission via the L2 U2N Relay UE after reception of the *RRCReconfiguration* message.

7. The source gNB sends the SN STATUS TRANSFER message to the target gNB to convey the uplink PDCP SN receiver status and the downlink PDCP SN transmitter status of the L2 U2N Remote UE's DRBs for which PDCP status preservation applies (i.e. for RLC AM).

8. The L2 U2N Remote UE synchronizes with the target gNB and performs Random Access.

9. The L2 U2N Remote UE sends *RRCReconfigurationComplete* message to target gNB via the direct path.

10. The target gNB sends the UE CONTEXT RELEASE message to inform the source gNB about the success of the path switch.

11. The source gNB sends *RRCReconfiguration* message to the L2 U2N Relay UE to reconfigure the connection between the L2 U2N Relay UE and the source gNB. The *RRCReconfiguration* message to the L2 U2N Relay UE can be sent any time after step 6 based on source gNB implementation (e.g., to release Uu Relay RLC channel and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration related to the L2 U2N Remote UE).

12. Either L2 U2N Relay UE or L2 U2N Remote UE's AS layer indicates upper layer to release PC5 unicast link after receiving the *RRCReconfiguration* message from the source gNB. The timing to execute link release is up to UE implementation.

#### 16.12.6.2 Switching from direct to indirect path

The gNB can select a L2 U2N Relay UE in any RRC state i.e., RRC\_IDLE, RRC\_INACTIVE, or RRC\_CONNECTED, as a target L2 U2N Relay UE for direct to indirect path switch.

For service continuity of L2 U2N Remote UE, the following procedure is used, in case of the L2 U2N Remote UE switching from direct to indirect path under the same gNB via a L2 U2N Relay UE in RRC\_CONNECTED:



Figure 16.12.6.2-1: Procedure for L2 U2N Remote UE intra-gNB switching from direct to indirect path via a L2 U2N Relay UE in RRC\_CONNECTED

1. The L2 U2N Remote UE reports one or multiple candidate L2 U2N Relay UE(s) and Uu measurements, after it measures/discovers the candidate L2 U2N Relay UE(s):

- The L2 U2N Remote UE filters the appropriate L2 U2N Relay UE(s) according to relay selection criteria before reporting. The L2 U2N Remote UE shall report only the L2 U2N Relay UE candidate(s) that fulfil the higher layer criteria;

- The reporting includes at least a L2 U2N Relay UE ID, a L2 U2N Relay UE's serving cell ID, and a sidelink measurement quantity information. SD-RSRP is used as sidelink measurement quantity.

2. The gNB decides to switch the L2 U2N Remote UE to a target L2 U2N Relay UE. Then the gNB sends an *RRCReconfiguration* message to the target L2 U2N Relay UE, which includes at least the L2 U2N Remote UE's local ID and L2 ID, Uu Relay RLC channel and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration.

3. The gNB sends the *RRCReconfiguration* message to the L2 U2N Remote UE. The *RRCReconfiguration* message includes at least the L2 U2N Relay UE ID, Remote UE's local ID, PC5 Relay RLC channel configuration for relay traffic and the associated end-to-end Uu radio bearer(s). The L2 U2N Remote UE stops User Plane and Control Plane transmission over the direct path after reception of the *RRCReconfiguration* message from the gNB.

4. The L2 U2N Remote UE establishes PC5-RRC connection with target L2 U2N Relay UE.

5. The L2 U2N Remote UE completes the path switch procedure by sending the *RRCReconfigurationComplete* message to the gNB via the L2 U2N Relay UE.

6. The data path is switched from direct path to indirect path between the L2 U2N Remote UE and the gNB.

For service continuity of L2 U2N Remote UE, the following procedure is used, in case of the L2 U2N Remote UE switching from direct to indirect path via a L2 U2N Relay UE in RRC\_CONNECTED under another gNB:



Figure 16.12.6.2-2: Procedure for L2 U2N Remote UE inter-gNB switching from direct to indirect path via a L2 U2N Relay UE in RRC\_CONNECTED

1. The L2 U2N Remote UE reports one or multiple candidate L2 U2N Relay UE(s) and Uu measurements to the source gNB, after it measures/discovers the candidate L2 U2N Relay UE(s):

- The L2 U2N Remote UE filters the appropriate L2 U2N Relay UE(s) according to relay selection criteria before reporting. The L2 U2N Remote UE shall report only the L2 U2N Relay UE candidate(s) that fulfil the higher layer criteria;

- The reporting includes at least a L2 U2N Relay UE ID, a L2 U2N Relay UE's serving cell ID, and a sidelink measurement quantity information. SD-RSRP is used as sidelink measurement quantity.

2. The source gNB decides to trigger path switch for the L2 U2N Remote UE onto indirect path of the target gNB, based on *MeasurementReport* and RRM information.

3. The source gNB sends a HANDOVER REQUEST message to the target gNB to prepare the path switch at the target side. The HANDOVER REQUEST message includes Remote UE L2 ID and a list of candidate target Relay UE IDs belonging to one cell of the target gNB.

4. Admission Control may be performed by the target gNB.

5. The target gNB selects one target Relay UE from the list of candidate Relay UEs provided by the source gNB, and sends the *RRCReconfiguration* message to L2 U2N Relay UE for relaying configuration, which includes at least the L2 U2N Remote UE's local ID and L2 ID, Uu Relay RLC channel and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration.

6. The target gNB sends the HANDOVER REQUEST ACKNOWLEDGE message to the source gNB, which contains new RRC configuration for L2 U2N Remote UE at the target side.

7. The source gNB sends the *RRCReconfiguration* message to the L2 U2N Remote UE, which includes at least the L2 U2N Relay UE ID, Remote UE's local ID, PC5 Relay RLC channel configuration for relay traffic and the associated Uu end-to-end radio bearer(s). The L2 U2N Remote UE stops User Plane and Control Plane transmission over the direct path after reception of the *RRCReconfiguration* message from the source gNB.

8. The source gNB sends the SN STATUS TRANSFER message to the target gNB to convey the uplink PDCP SN receiver status and the downlink PDCP SN transmitter status of the L2 U2N Remote UE's DRBs for which PDCP status preservation applies (i.e. for RLC AM).

9. The L2 U2N Remote UE establishes PC5 connection with L2 U2N Relay UE.

10. The L2 U2N Remote UE sends the *RRCReconfigurationComplete* message to target gNB via the L2 U2N Relay UE.

11. The data path is switched from direct path to indirect path between the L2 U2N Remote UE and the target gNB via the target L2 U2N Relay UE.

12. The target gNB sends the UE CONTEXT RELEASE message to inform the source gNB about the success of the path switch.

In case the selected L2 U2N Relay UE for direct to indirect path switch is in RRC\_IDLE or RRC\_INACTIVE, after receiving the path switch command, the L2 U2N Remote UE establishes a PC5 link with the L2 U2N Relay UE and sends the *RRCReconfigurationComplete* message via the L2 U2N Relay UE, which triggers the L2 U2N Relay UE to enter RRC\_CONNECTED state. The procedure for L2 U2N Remote UE switching to indirect path in Figure 16.12.6.2-1 can be also applied for the case that the selected L2 U2N Relay UE for direct to indirect path switch is in RRC\_IDLE or RRC\_INACTIVE with the exception that the *RRCReconfiguration* message is sent from the gNB to the L2 U2N Relay UE after the L2 U2N Relay UE enters RRC\_CONNECTED state, which happens during step 5 in Figure 16.12.6.2-1, and during step 10 in Figure 16.12.6.2-2.

#### 16.12.6.3 Switching from indirect to indirect path

The gNB can select an L2 U2N Relay UE in any RRC state i.e., RRC\_IDLE, RRC\_INACTIVE, or RRC\_CONNECTED, as a target L2 U2N Relay UE for indirect to indirect path switch.

For service continuity of L2 U2N Remote UE, the following procedure is used, in case of the L2 U2N Remote UE switching from indirect path via L2 U2N Relay UE to indirect path via a target L2 U2N Relay UE in RRC\_CONNECTED under the same gNB:



Figure 16.12.6.3-1: Procedure for L2 U2N Remote UE intra-gNB switching from indirect to indirect path via a target L2 U2N Relay UE in RRC\_CONNECTED

1. The L2 U2N Remote UE reports one or multiple candidate L2 U2N Relay UE(s) and sidelink measurement between the L2 U2N Remote UE and the source L2 U2N Relay UE to the source gNB, after it measures/discovers the candidate L2 U2N Relay UE(s):

- The L2 U2N Remote UE filters the appropriate L2 U2N Relay UE(s) according to relay selection criteria before reporting. The L2 U2N Remote UE shall report only the L2 U2N Relay UE candidate(s) that fulfil the higher layer criteria;

- The reporting includes at least a L2 U2N Relay UE ID, a L2 U2N Relay UE's serving cell ID, and a sidelink measurement quantity information. SD-RSRP is used as sidelink measurement quantity.

2. The gNB decides to switch the L2 U2N Remote UE to a target L2 U2N Relay UE under the same gNB.

3. The gNB sends an *RRCReconfiguration* message to the target L2 U2N Relay UE, which includes at least the L2 U2N Remote UE's local ID and L2 ID, Uu and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration.

4. The gNB sends the *RRCReconfiguration* message to the L2 U2N Remote UE. The *RRCReconfiguration* message includes at least the target L2 U2N Relay UE ID, Remote UE's local ID, PC5 Relay RLC channel configuration for relay traffic, and the associated end-to-end radio bearer(s). The L2 U2N Remote UE stops UP and CP transmission over the indirect path via the source L2 U2N Relay UE after the reception of the *RRCReconfiguration* message from the gNB.

5. The L2 U2N Remote UE establishes PC5-RRC connection with the target L2 U2N Relay UE.

6. The L2 U2N Remote UE sends *RRCReconfigurationComplete* message to the gNB via the target L2 U2N Relay UE.

7. The gNB sends the *RRCReconfiguration* message to the source L2 U2N Relay UE to reconfigure the connection between the source L2 U2N Relay UE and the gNB. The *RRCReconfiguration* message to the source L2 U2N Relay UE can be sent any time after step 4 based on gNB implementation (e.g., to release Uu and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration related to the L2 U2N Remote UE).

8. Either source L2 U2N Relay UE's AS layer or L2 U2N Remote UE's AS layer indicates upper layers to release PC5 unicast link after receiving the *RRCReconfiguration* message from the gNB. The timing to execute link release is up to UE implementation after step 4 or step7.

9. The data path is switched from the source L2 U2N Relay UE to the target L2 U2N Relay UE between the L2 U2N Remote UE and the gNB. This step can be any time after step 6.

For service continuity of L2 U2N Remote UE between inter-gNBs, the following procedure is used, in case of the L2 U2N Remote UE, which is connected to indirect path, switching to another indirect path via a target L2 U2N Relay UE in RRC\_CONNECTED under another gNB:



Figure 16.12.6.3-2: Procedure for L2 U2N Remote UE inter-gNB switching from indirect to indirect path via a target L2 U2N Relay UE in RRC\_CONNECTED

1. The L2 U2N Remote UE reports one or multiple candidate L2 U2N Relay UE(s) and sidelink measurement between the L2 U2N Remote UE and the source L2 U2N Relay UE to the source gNB, after it measures/discovers the candidate L2 U2N Relay UE(s):

- The L2 U2N Remote UE filters the appropriate L2 U2N Relay UE(s) according to relay selection criteria before reporting. The L2 U2N Remote UE shall report only the L2 U2N Relay UE candidate(s) that fulfil the higher layer criteria;

- The reporting includes at least a L2 U2N Relay UE ID, a L2 U2N Relay UE's serving cell ID, and a sidelink measurement quantity information. SD-RSRP is used as sidelink measurement quantity.

2. The source gNB decides to trigger the L2 U2N Remote UE to switch to an indirect path of another gNB.

3. The source gNB sends a HANDOVER REQUEST message to the target gNB to prepare the path switch at the target side. The HANDOVER REQUEST message includes Remote UE L2 ID and a list of candidate target relay UE IDs belonging to one cell of the target gNB.

NOTE: In order to support the DL lossless path switching for the L2 U2N Remote UE, the source gNB may not discard the DL data even though the delivery of the data has been acknowledged by the source L2 U2N Relay UE based on the gNB implementation. Then, the source gNB forwards the buffered DL data to the target gNB during the data forwarding procedure.

4. Admission Control may be performed by the target gNB.

5. The target gNB selects one target Relay UE from the list of candidate Relay UEs provided by the source gNB, sends the *RRCReconfiguration* message to the L2 U2N Relay UE for relaying configuration, which includes at least the L2 U2N Remote UE's local ID and L2 ID, Uu Relay RLC channel and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration.

6. The target gNB sends the HANDOVER REQUEST ACKNOWLEDGE message to the source gNB, which contains new RRC configuration for L2 U2N Remote UE at the target side.

7. The source gNB sends the *RRCReconfiguration* message to the L2 U2N Remote UE, which includes at least the target L2 U2N Relay UE ID, Remote UE's local ID, PC5 Relay RLC channel configuration for relay traffic and the associated end-to-end Uu radio bearer(s). The L2 U2N Remote UE stops User Plane and Control plane transmission over the (source) indirect path after reception of the *RRCReconfiguration* message from the source gNB.

8. The source gNB sends the SN STATUS TRANSFER message to the target gNB to convey the uplink PDCP SN receiver status and the downlink PDCP SN transmitter status of the L2 U2N Remote UE's DRBs for which PDCP status preservation applies (i.e. for RLC AM).

9. The L2 U2N Remote UE establishes PC5 connection to the target L2 U2N Relay UE.

10. The L2 U2N Remote UE sends the *RRCReconfigurationComplete* message to the target gNB via the target L2 U2N Relay UE.

11. The data path is switched from indirect path to indirect path between the L2 U2N Remote UE and the target gNB via the target L2 U2N Relay UE.

12. The target gNB sends the UE CONTEXT RELEASE message to inform the source gNB about the success of the path switch.

13. The source gNB sends the *RRCReconfiguration* message to the source L2 U2N Relay UE to reconfigure the connection between the source L2 U2N Relay UE and the source gNB. The *RRCReconfiguration* message to the source L2 U2N Relay UE can be sent any time after step 7 based on source gNB implementation (e.g., to release Uu Relay RLC channel and PC5 Relay RLC channel configuration for relaying, and bearer mapping configuration related to the L2 U2N Remote UE).

14. Either L2 U2N Relay UE or L2 U2N Remote UE's AS layer indicates upper layer to release PC5 unicast link after receiving the *RRCReconfiguration* message from the source gNB. The timing to execute link release is up to UE implementation.

In case the selected L2 U2N Relay UE for indirect to indirect path switch is in RRC\_IDLE or RRC\_INACTIVE, after receiving the path switch command, the L2 U2N Remote UE establishes a PC5 link with the L2 U2N Relay UE and sends the *RRCReconfigurationComplete* message via the L2 U2N Relay UE, which triggers the L2 U2N Relay UE to enter RRC\_CONNECTED state. The above procedures for L2 U2N Remote UE switching to indirect path can be also applied for the case that the selected L2 U2N Relay UE for indirect to indirect path switch is in RRC\_IDLE or RRC\_INACTIVE with the exception that the *RRCReconfiguration* message is sent from the gNB to the L2 U2N Relay UE after the L2 U2N Relay UE enters RRC\_CONNECTED state, which happens during step 6 in Figure 16.12.6.3-1, and during step 10 in Figure 16.12.6.3-2.

### 16.12.7 Control plane procedures for L2 U2U Relay

The L2 U2U Remote UE needs to establish end-to-end SL-SRB/DRBs with the peer L2 U2U Remote UE before user plane data transmission.

The following high level connection establishment procedure in Figure 16.12.7-1 applies to a L2 U2U Relay UE, L2 U2U Remote UE and the peer U2U Remote UE:



Figure 16.12.7-1: Procedure for L2 U2U Remote UE connection establishment

1. The L2 U2U Remote UE, L2 U2U Relay UE, and peer L2 U2U Remote UE perform discovery procedure or integrated discovery procedure.

2a. The L2 U2U Remote UE establishes/modifies a PC5-RRC connection with the selected L2 U2U Relay UE (i.e., as specified in TS 23.304 [48]).

2b. The L2 U2U Relay UE establishes/modifies a PC5-RRC connection with the peer L2 U2U Remote UE (i.e., as specified in TS 23.304 [48]).

3. The L2 U2U Relay UE allocates two local IDs and the two local IDs are delivered via *RRCReconfigurationSidelink* message to each of the L2 U2U Remote UEs: one local ID to identify the L2 U2U Remote UE, the other local ID to identify the peer L2 U2U Remote UE. When the local IDs are delivered, an L2 ID of the peer L2 U2U Remote UE is also delivered to the U2U Remote UE for making the association between the local ID and the L2 ID of the peer U2U Remote UE.

4. The L2 U2U Remote UE establishes end-to-end PC5-RRC connection with the peer L2 U2U Remote UE via the L2 U2U Relay UE. For the end-to-end connection establishment, fixed indexes (i.e., 0/1/2/3) are defined for end-to-end SL-SRB 0/1/2/3 respectively, and specified PC5 Relay RLC Channel configuration is used on each hop. The sidelink UE capability is exchanged between the L2 U2U Remote UEs via PC5-RRC (e.g., SL-SRB3) message.

5. The L2 U2U Remote UE sends to the L2 U2U Relay UE all the QoS profiles for the end-to-end QoS flows via PC5-RRC message.

6. The L2 U2U Relay UE performs QoS split only for PDB.

NOTE: It is up to L2 U2U Relay UE implementation on how to split PDB.

7. The L2 U2U Relay UE sends the split QoS value (i.e., PDB) via PC5-RRC message to the L2 U2U Remote UE.

8. The L2 U2U Remote UE or the serving gNB of the L2 U2U Remote UE derives the PDCP and SDAP configuration for end-to-end SL-DRB. The L2 U2U Remote UE provides the portion of the configuration related to reception to the peer L2 U2U Remote UE using end-to-end *RRCReconfigurationSidelink* messages. The end-to-end bearer IDs for SL-SRB and SL-DRB are used as input for the L2 U2U Relay ciphering and integrity protection at SL PDCP.

9a. The L2 U2U Remote UE or the serving gNB of the L2 U2U Remote UE derives the first hop configuration (e.g. PC5 Relay RLC Channel configuration) for SL-DRB. The L2 U2U Remote UE provides the L2 U2U Relay UE with the configuration related to receiving on the first hop (i.e., Rx by the relay UE), using per-hop *RRCReconfigurationSidelink* message.

9b. The L2 U2U Relay UE or the serving gNB of the L2 U2U Relay UE derives the second hop configuration (e.g. PC5 Relay RLC Channel configuration) for each SL-DRB.The Relay UE provides the peer L2 U2U Remote UE with the configuration related to receiving on the second hop (i.e., RX by the peer remote UE), using per-hop *RRCReconfigurationSidelink* message.

10. The L2 U2U Remote UE and the peer L2 U2U Remote UE transmit or receive data via L2 U2U Relay UE.

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| *Next change* |

## 16.21 Multi-path Relay

### 16.21.1 General

In multi-path relay scenario, a MP Remote UE is connected to a single gNB via one direct path and one indirect path while the MP Remote UE is in RRC\_CONNECTED state. For the indirect path, both L2 and L3 MP Relay architectures are supported. The L3 MP Relay architecture is transparent to the serving NG-RAN of the MP Relay UE, except for controlling sidelink resources. In the case of MP Remote UE using SL indirect path, mode 1 resource allocation is supported only for intra-DU case, with the SR/BSR and grant sent on the direct path.

In multi-path relay, the interface between MP Remote UE and MP Relay UE can be either PC5 or N3C. When the interface between MP Remote UE and MP Relay UE is N3C interface, the relationship of MP Remote UE and MP Relay UE is pre-configured or static, and it is up to the implementation of the MP Remote UE and MP Relay UE how to pre-configure or make it static.

Multi-path relay supports MP Remote UE and MP Relay UE when they are in the same gNB, and PCell is always on the direct path.

Multi-path relay is supported in the following cell deployment scenarios:

- The MP Relay UE and MP Remote UE are served by the same cell;

- The MP Relay UE and MP Remote UE are served by different intra-frequency cells of the same gNB;

- The MP Relay UE and MP Remote UE are served by different inter-frequency cells of the same gNB.

Multi-path relay is supported in the following sidelink scenarios:

- Sidelink TX/RX and Uu link share the same carrier at the MP Remote UE;

- Sidelink TX/RX and Uu link use different carriers at the MP Remote UE;

- Sidelink TX/RX and Uu link share the same carrier at the MP Relay UE;

- Sidelink TX/RX and Uu link use different carriers at the MP Relay UE.

### 16.21.2 Protocol Architecture

From L2 MP Remote UE perspective, three bearer types exist: direct bearer, indirect bearer, and split bearer. For direct bearer, only Uu radio resources are involved, and for indirect bearer, only PC5 or N3C radio resources are involved. For split bearer, both Uu and PC5/N3C radio resources are involved.

#### 16.21.2.1 L2 MP Relay using SL indirect path

For multi-path relay operation by using SL indirect path, the protocol stacks for the user plane and control plane of L2 MP Relay architecture are illustrated in Figure 16.21.2.1-1, 16.21.2.1-2.

If PC5 interface is used between L2 MP Remote UE and L2 MP Relay UE, the SRAP sublayer is placed above the RLC sublayer for both CP and UP at both PC5 interface and Uu interface of the indirect path. For the direct path, the Uu SDAP, PDCP, RLC, MAC, PHY, and RRC are terminated at gNB and L2 MP Remote UE. But for the indirect path, only the Uu SDAP, PDCP and RRC are terminated at gNB and L2 MP Remote UE, while SRAP, RLC, MAC, and PHY are terminated in each hop (i.e., the link between L2 MP Remote UE and L2 MP Relay UE and the link between L2 MP Relay UE and the gNB). PDCP duplication is supported for the MP split bearer.



Figure 16.21.2.1-1: User plane protocol stack for L2 Multi-path Relay using SL indirect path



Figure 16.21.2.1-2: Control plane protocol stack for L2 Multi-path Relay using SL indirect path

#### 16.21.2.2 L2 MP Relay using N3C indirect path

For the multi-path relay using N3C indirect path between the L2 MP Remote UE and L2 MP Relay UE, the protocol stacks for the user plane and control plane of L2 MP Relay architecture are illustrated in Figure 16.21.2.2-1 and Figure 16.21.2.2-2.

In the multi-path relay using N3C indirect path, the SRAP sublayer does not exist on the protocol stack. For the direct path the Uu SDAP, PDCP, RLC, MAC, PHY and RRC are terminated at gNB and L2 MP Remote UE. While RLC, MAC, and PHY in Uu hop of indirect path are terminated at L2 MP Relay UE and gNB. Without the SRAP sublayer over N3C, an UL PDCP PDU in the L2 MP Remote UE is delivered to RLC entity in the L2 MP Relay UE via N3C link based on UE implementation. It is supported for more than one RB over the Uu link of the L2 MP Relay UE by configuring 1:1 bearer mapping between the Radio bearer in the L2 MP Remote UE and Uu Relay RLC channel in the L2 MP Relay UE. The Uu logical channels for the PDU delivery of the L2 MP Relay UE's local traffic and relay traffic are configured differently. Bearer identification except LCID is not needed in L2 PDU over the Uu link. If the split bearer is configured and the PDCP duplication is activated, the duplicated PDCP PDUs are delivered via both direct path and indirect path.



Figure 16.21.2.2-1: User plane protocol stack for L2 Multi-path Relay using N3C indirect path



Figure 16.21.2.2-2: Control plane protocol stack for L2 Multi-path Relay using N3C indirect path

### 16.21.3 Control plane procedure for multi-path relaying

#### 16.21.3.1 Path Management

The L2 MP Remote UE needs to establish both a direct path and an indirect path. The L2 MP Remote UE adds the indirect path using PC5 link on top of the direct path under the same gNB. And also, the L2 MP Remote UE using PC5 link adds the direct path on top of the indirect path under the same gNB.

Meanwhile, the L2 MP Remote UE adds the indirect path using N3C link on top of the only direct path under the same gNB. But it is not allowed that the L2 MP Remote UE using N3C indirect path adds the direct path on top of the indirect path. The MP Relay UE using N3C indirect path is restricted to serve only one L2 MP Remote UE.

For L2 MP Remote UE, the direct path and the indirect path should be in the same gNB. The primary path of split SRB1 and SRB2 is always configured on direct path. In the L2 MP Remote UE, non-split SRB1/2 is allowed to be configured only on direct path.

Figure 16.21.3.1-1 describes the procedures for the indirect path addition on top of the direct path for the L2 MP relaying. This procedure is applicable to the L2 MP Remote UE using SL indirect path or N3C indirect path (except step 5).



Figure 16.21.3.1-1: Procedure for indirect path addition on top of direct path

0. The L2 MP Remote UE performs data transmission and reception by using direct path on PCell.

1. If the L2 MP Remote UE will be connected with L2 MP Relay UE using PC5 link, the L2 MP Remote UE reports at least the list of the candidate L2 MP Relay UE ID and the cell ID of the candidate L2 MP Relay UEs based on the measurement configuration from the gNB.

Meanwhile, if the MP Remote UE will be connected with L2 MP Relay UE using N3C link, the MP Remote UE reports at least the list of the C-RNTI and the cell ID of the candidate MP Relay UEs based on the measurement configuration from the gNB.

NOTE 1: The C-RNTI and cell ID of MP Relay UE using N3C link can be reported only if the secure connection between MP Remote UE and MP Relay UE is established.

2. The gNB decides to add the indirect path for the L2 MP Remote UE. The cell serving the direct path and the cell serving the L2 MP Relay UE on the indirect path belong to the same gNB but can be same or different.

3. The gNB sends an *RRCReconfiguration* message to the L2 MP Relay UE to configure the indirect path of the L2 MP Remote UE, if the L2 MP Relay UE is in RRC\_CONNECTED.

4. The gNB sends the *RRCReconfiguration* message to the L2 MP Remote UE.

5. The L2 MP Remote UE establishes a PC5 unicast link with the target L2 MP Relay UE.

NOTE 2: For the N3C indirect path addition, step 5 is omitted. It is L2 MP Remote UE's implementation how to make N3C indirect path between L2 MP Remote UE and L2 MP Relay UE.

6a. The L2 MP Remote UE sends the *RRCReconfigurationComplete* message to the gNB at least via the direct path in order to complete the indirect path addition procedure.

6b. If a split SRB1 with duplication is configured, the L2 MP Remote UE also sends the *RRCReconfigurationComplete* message to the gNB via the indirect path served by the L2 MP Relay UE.

NOTE 3: Step 5 can be executed after step 6a. Step 5 is independent of step 6a.

7. The L2 MP Remote UE performs data transmission and reception by using both the direct path on PCell and the indirect path served by a L2 MP Relay UE.

In the case that the selected L2 MP Relay UE for indirect path addition is in RRC\_IDLE or RRC\_INACTIVE, after receiving the path addition command, the L2 MP Remote UE should trigger the L2 MP Relay UE in RRC\_IDLE or RRC\_INACTIVE to move to RRC\_CONNECTED. If the L2 MP Remote UE and L2 MP Relay UE are connected by using N3C link, it is L2 MP Remote/Relay UE's implementation on how to trigger the RRC\_IDLE/RRC\_INACTIVE L2 MP Relay UE to initiate RRC connection establishment/resume procedure.

If the split SRB1 with duplication is not configured at the L2 MP Remote UE, the L2 MP Remote UE using SL indirect path sends PC5-RRC message to the L2 MP Relay UE. Upon receiving the PC5-RRC message, the L2 MP Relay UE in RRC\_IDLE or RRC\_INACTIVE initiates a Uu RRC connection establishment or an RRC connection resume.

If the split SRB1 with duplication is configured, the L2 MP Remote UE sends the *RRCReconfigurationComplete* message via the L2 MP Relay UE. The *RRCReconfigurationComplete* message triggers that the L2 U2N Relay UE in RRC\_IDLE or RRC\_INACTIVE initiates a Uu RRC connection establishment or an RRC connection resume for sending the *RRCReoncfigurationComplete* message to the gNB.

Figure 16.21.3.1-2 describes the procedures for the indirect path change under a single direct path in the L2 MP Relay operation. This procedure is applicable to the L2 MP Remote UE using SL indirect path or N3C indirect path (except step 5).



Figure 16.21.3.1-2: Procedure for indirect path change

0. The L2 MP Remote UE performs data transmission and reception by using both the direct path on PCell and the indirect path served by a source L2 MP Relay UE.

1. The L2 MP Remote UE performs measurements based on measurement configuration. When the measurement reporting is triggered, the L2 MP Remote UE using SL indirect link reports at least signal strength (e.g., SD-RSRP/SL-RSRP) of the serving indirect path, the list of the candidate L2 MP Relay UE ID and the cell ID of the candidate L2 MP Relay UEs.

Meanwhile, the MP Remote UE using N3C link reports at least the list of the C-RNTI and the cell ID of the candidate MP Relay UEs.

2. The gNB decides to change the indirect path of L2 MP Remote UE from the source L2 MP Relay UE to a target L2 MP Relay UE. The cell serving the direct path and the cell serving the source/target L2 MP Relay UE on the indirect path belong to the same gNB but can be same or different.

3a. The gNB sends an *RRCReconfiguration* message to the source L2 MP Relay UE to release the indirect path of the L2 MP Remote UE.

3b. The gNB sends an *RRCReconfiguration* message to the target L2 MP Relay UE to add the indirect path for the L2 MP Remote UE.

4. The gNB sends the *RRCReconfiguration* message to the L2 MP Remote UE on the direct path or both paths for indirect path change. If split SRB1 is configured, it is up to gNB implementation whether the *RRCReconfiguration* is sent via one of the paths or both paths.

NOTE 4: The ordering among step 3a, step 3b, and step 4 is up to gNB implementation.

5. The L2 MP Remote UE establishes a PC5-RRC connection with the target L2 MP Relay UE for using SL indirect path.

NOTE 5: For the N3C indirect path addition, step 5 is omitted. It is L2 MP Remote UE's implementation how to make N3C indirect path between L2 MP Remote UE and L2 MP Relay UE.

6a. The L2 MP Remote UE sends the *RRCReconfigurationComplete* message to the gNB at least via the direct path in order to complete the indirect path change procedure.

NOTE 6: Step 5 can be executed after step 6a. Step 5 is independent of step 6a.

6b. If a split SRB1 with duplication is configured, the L2 MP Remote UE also sends the *RRCReconfigurationComplete* message to the gNB via the indirect path served by the target L2 MP Relay UE.

7. The L2 MP Remote UE performs data transmission and reception by using both the direct path on PCell and the indirect path served by a target L2 MP Relay UE.

In the case that the selected target L2 MP Relay UE for indirect path change is in RRC\_IDLE or RRC\_INACTIVE, after receiving the path change command, the L2 MP Remote UE should trigger the target L2 MP Relay UE in RRC\_IDLE or RRC\_INACTIVE to be in RRC\_CONNECTED. If the target L2 MP Relay UE is not in RRC\_CONNECTED in step 3, the gNB sends an *RRCReconfiguration* message to the target L2 MP Relay UE after the target L2 MP Relay UE enters RRC\_CONNECTED.

If the split SRB1 with duplication is not configured, at the L2 MP Remote UE, the L2 MP Remote UE sends the *RRCReconfigurationComplete* message only on the direct path in Step 6a. The L2 MP Remote UE using SL indirect path can send a PC5-RRC message to the target L2 MP Relay UE in RRC\_IDLE or RRC\_INACTIVE after or during Step 5. The target L2 MP Relay UE in RRC\_IDLE or RRC\_INACTIVE initiates an RRC connection establishment or an RRC connection resume upon receiving the PC5-RRC message from the L2 MP Remote UE. If the target L2 MP Relay UE is in RRC\_IDLE or RRC\_INACTIVE, the *RRCReconfigurationComplete* message at Step 6b is sent to the gNB after the target L2 MP Relay UE enters RRC\_CONNECTED.

If the split SRB1 with duplication is configured, the L2 MP Remote UE sends the *RRCReconfigurationComplete* message via the target L2 MP Relay UE. The *RRCReconfigurationComplete* message triggers that the L2 U2N Relay UE in RRC\_IDLE or RRC\_INACTIVE initiates an RRC connection establishment or an RRC connection resume for sending the *RRCReconfigurationComplete* message to the gNB at Step 6b.

Figure 16.21.3.1-3 describes the procedures for the direct path addition on top of the indirect path for the L2 MP Relay operation. This procedure is only applicable to the L2 MP Remote UE using SL indirect path.



Figure 16.21.3.1-3: Procedure for direct path addition on top of indirect path

0. The L2 MP Remote UE performs data transmission and reception by using indirect path via PC5 link.

1. The L2 MP Remote UE performs measurements based on measurement configuration. When the measurement reporting is triggered, the L2 MP Remote UE reports at least the Uu signal strength of the serving cell and neighbour cells with the cell IDs (i.e., NCGI/NCI).

2. The gNB decides to add the direct path for the L2 MP Remote UE. The cell serving the direct path and the cell serving the L2 MP Relay UE on the indirect path belong to the same gNB but can be same or different.

3. The gNB sends an *RRCReconfiguration* message to the L2 MP Relay UE to update the indirect path configuration, if necessary.

4. The gNB sends the *RRCReconfiguration* message to the L2 MP Remote UE via the L2 MP Relay UE. The contents in the *RRCReconfiguration* message includes at least a target cell within direct path addition configuration.

5. The L2 MP Remote UE synchronizes to DL of the target cell serving the direct path and performs random access procedure towards the cell serving the direct path. The L2 MP Remote UE configures the target cell as PCell.

6a. The L2 MP Remote UE sends the *RRCReconfigurationComplete* message to the gNB at least via the direct path in order to complete the direct path addition procedure.

6b. If a split SRB1 with duplication is configured, the L2 MP Remote UE also sends the *RRCReconfigurationComplete* message to the gNB via the indirect path served by the L2 MP Relay UE.

7. The L2 MP Remote UE performs data transmission and reception by using both the direct path on PCell and the indirect path served by a L2 MP Relay UE.

Figure 16.21.3.1-4 describes the procedures for the direct path change on top of the indirect path for the L2 MP Relay operation. This procedure is only applicable to the L2 MP Remote UE using SL indirect path.



Figure 16.21.3.1-4: Procedure for direct path change

0. The L2 MP Remote UE performs data transmission and reception by using both the direct path on the source PCell and the indirect path served by a L2 MP Relay UE.

1. The L2 MP Remote UE performs measurements based on measurement configuration. The L2 MP Remote UE may report measurement results.

2. The gNB decides to change the direct path of the L2 MP Remote UE from the PCell (i.e. source PCell) to a new cell (i.e. target PCell). The source/target PCell serving the old/new direct path and the cell serving the L2 MP Relay UE on the indirect path belong to the same gNB but can be same or different.

3. The gNB sends an *RRCReconfiguration* message to the L2 MP Relay UE to update the indirect path configuration, if necessary.

4. The gNB sends the *RRCReconfiguration* message to the L2 MP Remote UE on the direct path and/or the indirect path for direct path change.

5. The L2 MP Remote UE synchronizes to DL of the target PCell serving the new direct path and performs random access procedure towards the target PCell serving the new direct path.

6a. The L2 MP Remote UE sends the *RRCReconfigurationComplete* message to the gNB at least via the direct path in order to complete the direct path change procedure.

6b. If a split SRB1 with duplication is configured, the L2 MP Remote UE also sends the *RRCReconfigurationComplete* message to the gNB via the indirect path served by the L2 MP Relay UE.

7. The L2 MP Remote UE performs data transmission and reception by using both the direct path on the target PCell and the indirect path served by a L2 MP Relay UE.

If the direct path addition/change is failed, the L2 U2N Remote UE always shall trigger *RRCReestablishment*.

#### 16.21.3.2 Path Failure Report

The L2 MP Remote UE in RRC\_CONNECTED performs Uu RLM (as described in clause 9.2.7).

When the L2 MP Remote UE detects Uu Radio Link Failure (RLF) on the direct path, the L2 MP Remote UE triggers path failure reporting through the indirect path via a RRC message if split SRB1 is configured and the indirect path is not suspended. Otherwise, RRC connection re-establishment is initiated.

When the L2 MP Remote UE using PC5 indirect path detects PC5 Radio Link Failure (RLF) and/or Uu link failure on the indirect path, the L2 MP Remote UE triggers path failure reporting through the direct path via a RRC message, if the direct path is not suspended.

When the L2 MP Remote UE using N3C indirect path detects N3C link failure and/or Uu link failure on the indirect path, the L2 MP Remote UE triggers path failure reporting through the direct path via a RRC message, if the direct path is not suspended.

16.21.3.3 System Information

The L2 MP Remote UE can acquire any necessary SIB(s) over Uu interface or indirect path. If common search space for system information is configured with the active BWP on PCell, the L2 MP Remote UE can perform direct system information acquisition on PCell. The L2 MP Remote UE can also receive system information at lease PBCH/MIB on the direct path and directly acquires SFN from MIB on the direct path. Besides, the L2 MP Remote UE can receive the system information via dedicated RRC signalling via SRB1.

|  |
| --- |
| *End of change* |