**3GPP TSG-RAN WG2 Meeting #114 Electronic R2-210NNNN**

**Online Meeting, May 19 – 27, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.300** | **CR** |  | **rev** |  | **Current version:** | **16.5.0** |  |
|  |
| *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 Rel-17 Sidelink Relay |
|  |  |
| ***Source to WG:*** | MediaTek Inc. |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_SL\_relay-Core |  | ***Date:*** | 2021-05-30 |
|  |  |  |  |  |
| ***Category:*** | ***B*** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | This CR introduces the support of sidelink relay in NR |
|  |  |
| ***Summary of change:*** | Introduction of general description, protocol architecture, relay discovery, relay selection/reselection, control plane procedures and service continuity aspects for sidelink relay |
|  |  |
| ***Consequences if not approved:*** | Sidelink Relay is not supported in NR |
|  |  |
| ***Clauses affected:*** | 2, 3.1, 3.2, 16.X (New) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*First Modified Subclause*

# 2 References

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

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

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

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

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

[2] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[3] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[4] 3GPP TS 38.401: "NG-RAN; Architecture description".

[5] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System".

[6] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[7] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".

[8] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[9] 3GPP TS 37.324: " E-UTRA and NR; Service Data Protocol (SDAP) specification".

[10] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".

[11] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[13] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[14] 3GPP TS 22.168: "Earthquake and Tsunami Warning System (ETWS) requirements; Stage 1".

[15] 3GPP TS 22.268: "Public Warning System (PWS) Requirements".

[16] 3GPP TS 38.410: "NG-RAN; NG general aspects and principles".

[17] 3GPP TS 38.420: "NG-RAN; Xn general aspects and principles".

[18] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[19] 3GPP TS 22.261: "Service requirements for next generation new services and markets".

[20] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer"

[21] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".

[22] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[23] IETF RFC 4960 (2007-09): "Stream Control Transmission Protocol".

[24] 3GPP TS 26.114: "Technical Specification Group Services and System Aspects; IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[25] Void.

[26] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[27] IETF RFC 3168 (09/2001): "The Addition of Explicit Congestion Notification (ECN) to IP".

[28] 3GPP TS 24.501: "NR; Non-Access-Stratum (NAS) protocol for 5G System (5GS)".

[29] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[30] 3GPP TS 38.415: "NG-RAN; PDU Session User Plane Protocol".

[31] 3GPP TS 38.340: "NR; Backhaul Adaptation Protocol (BAP) specification".

[32] 3GPP TS 38.470: "NG-RAN; F1 application protocol (F1AP) ".

[33] 3GPP TS 38.425: "NG-RAN; NR user plane protocol".

[34] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC); Stage 2".

[35] 3GPP TS 38.101-2: "User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[36] 3GPP TS 38.101-3: "User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[37] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access".

[38] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[39] 3GPP TS 22.104 "Service requirements for cyber-physical control applications in vertical domains".

[40] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[41] 3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".

[42] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[43] 3GPP TS 37.355: "LTE Positioning Protocol (LPP)".

[xx] 3GPP TS 23.304: "Proximity based Services (ProSe) in the 5G System (5GS)".

[yy] 3GPP TS 23.303: " Proximity-based services (ProSe); Stage 2".

# 3 Definitions and Abbreviations

## 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

A-CSI Aperiodic CSI

AKA Authentication and Key Agreement

AMBR Aggregate Maximum Bit Rate

AMC Adaptive Modulation and Coding

AMF Access and Mobility Management Function

ARP Allocation and Retention Priority

BA Bandwidth Adaptation

BCH Broadcast Channel

BH Backhaul

BL Bandwidth reduced Low complexity

BPSK Binary Phase Shift Keying

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

CFRA Contention Free Random Access

CHO Conditional Handover

CIoT Cellular Internet of Things

CLI Cross Link interference

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

CPC Conditional PSCell Change

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

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

E-CID Enhanced Cell-ID (positioning method)

EHC Ethernet Header Compression

ETWS Earthquake and Tsunami Warning System

FS Feature Set

GFBR Guaranteed Flow Bit Rate

HRNN Human-Readable Network Name

IAB Integrated Access and Backhaul

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

LDPC Low Density Parity Check

L2 Layer-2

L3 Layer-3

MDBV Maximum Data Burst Volume

MIB Master Information Block

MICO Mobile Initiated Connection Only

MFBR Maximum Flow Bit Rate

MMTEL Multimedia telephony

MNO Mobile Network Operator

MPE Maximum Permissible Exposure

MT Mobile Termination

MU-MIMO Multi User MIMO

Multi-RTT Multi-Round Trip Time

NB-IoT Narrow Band Internet of Things

NCGI NR Cell Global Identifier

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

P-MPR Power Management Maximum Power Reduction

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PNI-NPN Public Network Integrated NPN

PO Paging Occasion

PRACH Physical Random Access Channel

PRB Physical Resource Block

PRG Precoding Resource block Group

PS-RNTI Power Saving RNTI

PSS Primary Synchronisation Signal

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

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

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

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SFI-RNTI Slot Format Indication RNTI

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SMC Security Mode Command

SMF Session Management Function

S-NSSAI Single Network Slice Selection Assistance Information

SNPN Stand-alone Non-Public Network

SNPN ID Stand-alone Non-Public Network Identity

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TPC Transmit Power Control

TRP Transmit/Receive Point

U2N UE-to-Network

UCI Uplink Control Information

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

V2X Vehicle-to-Everything

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

## 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].

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

**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.

**Direct Path**: a type of UE-to-Network transmission path, where data is transmited between a U2N Remote UE and the network without 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.

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

**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.

**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.

**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.

**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.

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

**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.

**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], between two or more nearby UEs, using NR technology but not traversing any network 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

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

**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).

**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.

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

**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.

*Next Modified Subclause (new)*

## 16.x Sidelink Relay

### 16.x.1 General

*Editor’s Note: the general description for sidelink relay is provided in this section based on TR38.836. Describe both L2 and L3 relay in general. A system architecture may be depicted from RAN perspective. This section can also describe the subtopics that does not need be assigned with a separate sub-section.*

*Editor’s Note: The following paragraph is to capture the agreement of “RRC state combination of Relay UE in RRC\_IDLE and Remote UE in RRC\_INACTIVE is supported.”. the additional text is sourced from TR38.836*

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 U2N Relay and U2N Remote UE shall be in RRC CONNECTED to perform transmission/reception of relayed unicast data.

- The U2N Relay UE can be in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED as long as all the PC5-connected U2N Remote UE(s) are either in RRC\_INACTIVE or in RRC\_IDLE.

### 16.x.2 Protocol Architecture

*Editor’s Note: L3 architecture is described by text only based on TR38.836. L2 User plane and control plane protocol architecture to be described in this section based on TR38.836 and the conclusion of PC5 adaptation layer. Describe also the high level function of adaptation layer. QoS handling can also be described here in case of any RAN specific impact.*

### 16.x.3 Relay Discovery

Model A and Model B discovery model as defined in clause 5.3.1.2 of TS 23.303 [yy] are supported for U2N Relay operation. The protocol stack of discovery message is described in Figure 16.x.3-1.



Figure 16.x.3-1 Protocol Stack of Discovery Message for UE-to-Network Relay

The U2N Remote UE can perform Relay discovery message (i.e. as specified TS 23.304 [xx]) transmission while in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED. The network may broadcast a threshold, which is used by the U2N Remote UE to determine if it can transmit Relay discovery solicitation messages to U2N Relay UE(s).

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

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

The resource pool for Relay discovery can be shared with the resource pool for NR Sidelink communication and the resource pool for Relay discovery can also be a dedicated resource pool. Whether the dedicated resource pool is configured is based on network implementation.The resource pool allocation is same as NR sidelink communication.

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

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

### 16.x.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 critera, as specified in TS 23.304 [xx]. When there is no unicast PC5 connection between the U2N Relay UE and the U2N Remote UE, U2N Remote UE uses SD-RSRP measurements to evaluate whether PC5 link quality of a U2N Relay UE satisfies relay selection criterion.

For relay reselection, U2N Remote UE uses SL-RSRP measurements 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 in terms of radio criteria if the PC5 link quality exceeds configured threshold (pre-configured or provided by gNB). The U2N Remote UE searches for suitable U2N Relay UE candidates which meet all AS layer and higher layer criteria [xx]. If there are multiple such candidate 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 is below a configured signal strength threshold;

- Indicated by upper layer

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

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

- PC5 connection is released with current U2N Relay UE as indicated by upper layer (e.g. due to Uu RLF is detected by U2N Relay UE, or U2N Relay UE performs handover to another gNB)

- When U2N Remote UE detects PC5 RLF

- Indicated by upper layer.

For L2 U2N Remote UEs in RRC\_IDLE/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 UE implementation to select either a cell or a U2N relay UE. Besides, L3 U2N Remote UE’s selection on both cell and U2N Relay UE is also based on UE implementation.

### 16.x.5 Control plane procedures for L2 U2N relay

*Editor’s Note: describe the high level control plane procedures including connection management, system information, paging, access control etc.*

#### 16.x.5.1 RRC Connection Management

*Editor’s Note: Need to describe the connection establishment and reestablishment aspects in this subsection.*

The U2N Remote UE in RRC\_CONNECTED suspends Uu RLM when U2N Remote UE is connected to gNB via U2N Relay UE. The Uu RLF indication from U2N Relay UE may trigger connection re-establishment for U2N Remote UE. Upon detecting PC5 RLF, the U2N Remote UE may trigger connection re-establishment.

The U2N Remote UE may perform RRC re-establishment procedure as follows:

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

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

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

In case the U2N Remote UE initiates RRC resume to a new gNB, the legacy Retrieve UE Context procedure is performed, i.e., the new gNB retrieves the Remote UE context for U2N Remote UE.

The U2N Remote UE performs RNAU procedure while in RRC\_INACTIVE. For U2N Remote UE in coverage, it performs RNAU based on its own serving cell information if it is not PC5-connected with a U2N Relay UE.

#### 16.x.5.2 System Information

The U2N Remote UE can receive the system information via PC5 after PC5 connection establishment with U2N Relay UE.

The U2N Remote UE in RRC\_CONNECTED can use the NR on-demand SIB framework as specified in TS38.331 [12] to request the SIB(s) via U2N Relay UE. The U2N Remote UE in RRC\_IDLE or RRC\_INACTIVE can inform U2N Relay UE on its requested SIB type(s) via PC5-RRC message. Then, U2N Relay UE triggers on-demand SI/SIB acquisition procedure as specified in section of 5.2.2.3 of TS38.331 [12] according to its own RRC state (if needed) and sends the acquired SI(s)/SIB(s) to U2N Remote UE via PC5-RRC.

#### 16.x.5.3 Paging

When both U2N Relay UE and U2N Remote UE are in RRC IDLE/RRC INACTIVE, the U2N Relay UE monitors paging occasions of its PC5-RRC connected U2N Remote UE(s). When a U2N Relay UE needs to monitor paging for a U2N Remote UE, the U2N Relay UE should monitor all POs for the U2N Remote UE.

Unicast can be used for the paging forwarding via PC5.

When both U2N Relay UE and U2N Remote UE are in RRC CONNECTED, the U2N Relay UE may monitor SI change indication and/or PWS notifications in any PO as defined in TS 38.304 .

#### 16.x.5.4 Access Control

The U2N Remote UE performs unified access control as defined in TS 38.331. The U2N Relay UE in RRC-CONNECTED should not perform UAC for U2N Remote UE’s data.

### 16.x.6 Service Continuity for L2 U2N relay

*Editor's Note: This section describes the high level procedures of service continuity for L2 U2N relay*

# Annex - Collection of RAN2 agreements on NR SL Relay WI

Cyan highlight – agreement captured in stage-2 specifications

Green highlight – stage-3 level agreement, not captured in stage-2 specifications

No highlight – agreement with no direct impact on specifications

## RAN2#113bis-e agreements

***Relay discovery***

* As in LTE, the RRC\_IDLE/RRC\_INACTIVE relay UE is able to perform discovery message transmission, in case:

- Uu RSRP is above a configured minimum threshold by a hysteresis and below a configured maximum threshold by a hysteresis, or

- only minimum threshold is provided and Uu RSRP is above the minimum threshold by a hysteresis, or

- only maximum threshold is provided and Uu RSRP is below the maximum threshold by a hysteresis

* As in LTE, the RRC\_IDLE/RRC\_INACTIVE remote UE is able to perform discovery message transmission, if and only if Uu RSRP of serving cell is below a configured minimum threshold by a hysteresis.
* Define threshHighRelay and threshLowRelay for relay UE and threshHighRemote for remote UE. The value range for the three thresholds can be half of RSRP-Range specified in TS 38.331.
* One new SL-SRB4 is used for all discovery messages. Its parameters will be fixed and defined as SCCH configuration in 38.331. (FFS on the LCH priority in Proposal 8b)
* No ciphering and integrity protection in PDCP layer is needed for the discovery messages.
* [609] Shared resource pool shall be the baseline for discovery message transmission/reception.
* [609] For determining whether remote UE and/or relay UE in RRC CONNECTED can trigger discovery message transmission, i.e., the remote UE and relay UE in the RRC\_CONNECTED can use the threshold based methods as in IDLE/INACTIVE, to determine whether it is allowed to perform discovery message transmission.
* [609] Relay UE and remote UE (IC) in RRC CONNECTED can use the discovery configuration provided via dedicated signalling if available.
* [609] Relay UE and remote UE (IC) in RRC IDLE or RRC INACTIVE shall use the discovery configuration provided via SIB if available.
* [609] WA: L3 relay UE uses pre-configuration for discovery, only if the discovery SIB configuration is not provided by gNB, in case its serving carrier is not shared with carrier for sidelink operation. Otherwise, L3 relay UE uses the configuration for discovery provided by gNB.
* [609] L2 relay UE will always use the discovery configuration provided by gNB (either via SIB or dedicated signalling).
* [609] FFS: Remote UE (regardless of L2 relaying or L3 relaying) performs discovery based on pre-configuration, only if the discovery configuration is not provided by gNB (regardless not provided, or not able to provide, or not able to obtain in OOC, etc.). Otherwise, Remote UE uses the configuration for discovery provided by gNB..

***Relay re/selection***

* For relay (re)selection, RAN2 clarify that only the common parts of L2 and L3 relay is required to be completed by RAN#92. L2 specific design may be discussed in L2 relay agenda items in contribution driven manner.
* RAN2 confirm below NR relay (re)selection procedures which are same as LTE Prose relay:

1) PC5 Measurement: For relay(s) without unicast PC5 sconnection, remote UE uses RSRP measurements of sidelink discovery messages (i.e. SD-RSRP) to evaluate whether PC5 link quality of a Relay UE satisfies relay selection and reselection criterion

2) Trigger of relay selection: Triggered at remote UE when: a) direct Uu link quality is below a configured threshold for an in-coverage remote UE (in IDLE/INACTIVE and CONNECTED for L3 U2N relay; L2 case to be further discussed); or b) triggered by upper layer

3) Trigger of relay reselection: Triggered at remote UE when: a) PC5 measurement towards current relay UE is below a (pre)configured threshold; or b) Reception of an upper layer release message or similar indication from current relay UE; or c) Triggered by upper layer

4) How to choose relay UE in relay (re)selection: Remote UE searches for suitable relay UE candidates which meet all AS-layer & higher layer criteria. If multiple such candidate relay UEs available, it is up to Remote UE implementation to choose one Relay UE.

* Same as LTE, Uu link threshold (like threshHigh-r13), PC5 link threshold(like q-RxLevMin-r13), L3 filter coefficient for SD-RSRP/SL-RSRP (like filterCoefficient-r13) and hysteresis (like hystMax-r13 and minHyst-r13) can be provided via SIB/RRC by gNB or pre-configuration. Handling of Uu link threshold being absent can reuse LTE approach (i.e. when absence, remote UE considers condition to be met).
* In SD-RSRP measurement for relay (re)selection trigger and candidate relay evaluation, L3 filtering is applied across measurements on the DMRS of PSSCH transmission which carries discovery message from the concerned relay.
* RAN2 confirm that remote UE triggers relay reselection if PC5 RLF with current relay UE is detected by remote UE. FFS if there is any impact to other RLF handling activities.
* Uu quality between relay UE and gNB is not included in discovery message as additional AS criteria for relay (re)selection
* Include the information required for agreed additional AS criteria in discovery message.
* [610] For L3 relay, the use of PLMN ID and cell ID in relay (re)selection is up to SA2
* [610] For L2 relay, PLMN ID supported as additional AS criteria for relay (re)selection. Whether cell ID is used can be further discussed by RAN2.
* [610] Besides serving cell ID, PLMN ID, L2/L3 relay support (if agreed in discovery session) and relay load, other additional AS criteria are not considered in this release.
* [611] For L2/L3 relay common parts of relay (re)selection, RAN2 confirm that there is no support of service continuity from AS layer perspective
* [611] gNB controlled relay (re)selection” or “gNB controlled path switch” belong to L2 relay service continuity agenda item, and they are not treated in relay (re)selection discussion by RAN#92
* [611] QoS controlled relay (re)selection is not treated in relay (re)selection discussion by RAN#92
* [611] When PC5 RLF is detected by relay UE on a PC5 unicast link towards a remote UE, relay UE in RRC\_CONNECTED sends the PC5 RLF indication to gNB (as supported in R16 specification).
* [611] When Uu RLF is detected by relay UE, relay UE may send a PC5-S message (similar to LTE) to its connected remote UE(s) and this message may trigger relay reselection. FFS other indication/message can also be used for notification.
* [611] When relay performs HO to another gNB, relay UE may send a PC5-S message (similar to LTE) to its connected remote UE(s) and this message may trigger relay reselection. FFS other indication/message can also be used for notification
* [611] If both a suitable cell and a suitable relay are available, the remote UE can select either one (or both, for L3 relay only) based on its implementation in this release (i.e. TS 38.304 will not specify any additional procedure for selecting between the cell and the relay). FFS whether any enhancements to the cell (re)selection procedure for L2 relay.

***L2 relay control procedure***

* [603] The remote UE should perform TAU/RNAU procedure while in RRC\_INACTIVE and RRC\_IDLE. No LS to be sent from this meeting to SA2/ CT1/RAN3 on the remote UE’s TAU/RNAU procedure.
* [603] For the delivery of remote UE’s SRB0 RRC message, specified (fixed) configuration is used for the configuration of PC5 RLC channel. FFS for the Uu RLC channel.
* [603] For the delivery of remote UE’s SRB1 RRC message other than RRCResume and RRCReestablishment message, network configuration via dedicated signalling is used for the configuration of PC5 RLC channel and Uu RLC channel.
* [603] For the delivery of remote UE’s SRB1 RRC message such as RRCResume and RRCReestablishment message, default configuration is used for the configuration of PC5 RLC channel which can be reconfigured by network. FFS for Uu RLC channel.
* [603] For the delivery of remote UE’s SRB2 RRC message, network configuration via dedicated signalling is used for the configuration of PC5 RLC channel and Uu RLC channel.
* [603] For the delivery of remote UE’s Uu DRB packet, network configuration via dedicated signalling is used for the configuration of PC5 RLC channel and Uu RLC channel.
* [603] For the PC5 RLC channel configuration, only the RLC/LCH configuration is provided to the relay UE and remote UE.
* [603] For the Uu RLC channel configuration, only the RLC/LCH configuration is provided to the relay UE.
* [603] For the remote UE’s SRB1/SRB2 configuration, only the Uu PDCP configuration is provided to the remote UE.
* [603] For the remote UE’s DRB configuration, only the Uu PDCP/SDAP configuration is provided to the remote UE.
* [603] For RRC\_Connected remote UE, RAN2 confirm that DedicatedSIBRequest procedure is re-used for the Remote UE to request the SI via relay UE.
* [603] For RRC\_Idle/INACTIVE remote UE, remote UE informs relay UE on requested SIB type(s) via PC5 RRC message. Then, relay UE triggers legacy on-demand SI acquisition procedure according to its own RRC state (if needed) and sends the acquired SIB to remote UE.
* [603] PC5-RRC message can be used to carry the system information forwarding via PC5.
* [603] Suppose a relay UE needs to monitor paging for a remote UE, the relay UE should monitor all POs for the remote UE as a baseline.
* [603] Unicast can be used for the paging forwarding via PC5.
* [603] WA: Remote UE can reuse legacy access control and no need to enhance the access control procedure of Remote UE. FFS whether the relay UE performs UAC for itself.

***L2 relay Protocol architecture***

* [604] For both DL and UL transmission of Uu radio bearers other than SRB0, identity information of a remote UE and its Uu radio bearer are included in the header of adaptation layer over Uu. FFS for SRB0. FFS if the presence of adaptation layer header can be configurable. (24/24)
* [604] The radio bearer ID in the adaptation layer header is the Uu radio bearer ID of the remote UE. (23/24)
* [604] The UE ID in the adaptation layer header is a local, temporary remote UE ID. FFS whether the local, temporary remote UE ID is assigned by the relay UE, or the serving gNB of the relay UE. (23/24)
* [604] Mapping is done at Relay UE between PC5 RLC bearer IDs, identity information of remote UE and Uu radio bearer, and Uu RLC bearer IDs.

## RAN2#114-e agreements

***Relay discovery***

* Proposal 3b (modified): RAN2 confirm the SI conclusion that for L2 remote UE which is out-of-coverage, and is neither in RRC\_CONNECTED nor RRC\_IDLE/INACTIVE, it can rely on pre-configuration.
* Proposal 4 (modified): RAN2 confirm the SI conclusion that for L3 remote UE which is out-of-coverage, and is neither in RRC\_CONNECTED nor RRC\_IDLE/INACTIVE, it should follow pre-configuration.
* Proposal 3a (modified): RAN2 agree that for L2 remote UE which is out-of-coverage, but connected to network via a relay UE (i.e., either in RRC CONNECTED or RRC IDLE/INACTIVE), it should follow network configuration, i.e., SIB or dedicated signalling, if available.
* Proposal 1b: RAN2 agree that for relay/remote UE in RRC IDLE/INACTIVE state, in-coverage on the serving frequency, and the serving frequency is not shared with concerned frequency, if the configuration of concerned SL frequency is absent within the SIB of the serving frequency or if there is no discovery related SIB on the serving frequency

- If there is Uu coverage at the concerned SL frequency, UE shall 1) rely on the discovery related SIB, if any broadcasted in the concerned SL frequency; Or 2) if there is no discovery related SIB on the concerned SL frequency, UE does not perform SL discovery transmission/reception on the concerned frequency.

- If there is no Uu coverage at the concerned frequency, UE shall rely on pre-configuration.

* Proposal 1c: RAN2 agree that for relay/remote UE in RRC IDLE/INACTIVE state, in-coverage on the serving frequency，if the serving frequency is shared with concerned SL frequency

- If there is no discovery related SIB broadcasted on the serving carrier, UE does not perform SL discovery transmission/reception on the concerned frequency.

* Proposal 6: RAN2 agrees to reuse Rel-16 power control mechanism for transmission of discovery messages.
* Proposal 8: The same PDCP data PDU format as SL-SRB0 is used for sidelink discovery message (SL-SRB4), and the SDU type field is not used for SL-SRB4.
* Proposal 9: RAN2 agrees to postpone the discussion related to resource allocation to after RAN#92-e.
* Proposal 10: RAN2 to postpone the issue on network capability differentiation to stage 3 ASN.1 discussion.
* Proposal 11: RAN2 rely on SA2 on the L2 ID design for discovery message. No LS is needed.
* Proposal 13: De-prioritize additional condition for discovery transmission/reception in Rel-17.
* [617]Proposal 1 [easy]: RAN2 agrees that for relay/remote UE in RRC IDLE/INACTIVE state, and in-coverage on the serving frequency, if there is discovery related SIB broadcasted on the serving frequency, and if the configuration of concerned SL frequency is included within the SIB of the serving frequency but the Tx resource pool configuration is absent, UE shall enter RRC CONNECTED state to acquire dedicated configuration on Tx resource pool.
* [617]Proposal 2 [easy]: RAN2 agree that RRC\_CONNECTED relay/remote UE which are in-coverage on the serving frequency, if there is discovery related SIB broadcasted on the serving frequency, and if the configuration of concerned SL frequency is included within the SIB of the serving frequency, it can only use the SL discovery Tx resource configuration provided by dedicated signalling if provided, or not transmit discovery if not provided.
* [617]Proposal 3a [easy]: RAN2 agree that RRC\_CONNECTED L3 relay/remote UE or layer 2 remote UE which are in-coverage on the serving frequency, and the serving frequency is not shared with concerned frequency, if the configuration of concerned SL frequency is absent within the SIB of the serving frequency or if there is no discovery related SIB on the serving frequency,

- If there is Uu coverage at the concerned SL frequency, UE shall 1) rely on the discovery related SIB, if any broadcasted in the concerned SL frequency; Or 2) if there is no discovery related SIB on the concerned SL frequency, UE does not perform SL discovery transmission/reception on the concerned frequency.

- If there is no Uu coverage at the concerned frequency, UE shall rely on pre-configuration.

* [617]Proposal 4a [easy]: RAN2 agree that for L2 remote UE which is out-of-coverage, but connected to network via a relay UE and in RRC IDLE/INACTIVE state, if the network configuration is not available, i.e., SIB, remote UE shall rely on pre-configuration to perform discovery.
* [617]Proposal 5 [easy]: RAN2 agrees to down-prioritize discovery specific resource allocation optimization in this release.
* [617]Proposal 9 [easy]: RAN2 agrees to down-prioritize the support of discovery gaps in this release.
* [617]Proposal 4b [discussion]: RAN2 agree that for L2 remote UE which is out-of-coverage, but connected to network via a relay UE and in RRC CONNECTED state, if the network configuration is not available, i.e., SIB or dedicated signalling, remote UE shall rely on pre-configuration to perform discovery.
* [617]Proposal 6 [discussion]: RAN2 agrees dedicated discovery resource pool is supported besides shared resource pool configuration, whether it is configured is based on network implementation. And PHY layer parameters and design shall reuse the Rel-16 legacy resource pool design (including resource allocation design).
* [617]RAN2 agree that the UE selection between dedicated and shared pool can be discussed as a stage 3 issue after RAN#92-e.
* [617]Proposal 8 [discussion]: RAN2 agrees to fix the priority value as 1 of sidelink discovery message in the specification.

***Relay (re)selection***

* Relay load is not considered as a (re)selection criterion in Rel-17.
* Use only SL-RSRP if available; discuss the no data case by email.
* Proposal 3: For L2 U2N relay, RRC\_IDLE/RRC\_INACTIVE remote UE triggers relay selection when direct Uu link quality is below a configured threshold, and relay selection for RRC\_CONNECTED remote UE by gNB is handled in CP procedure and service continuity topic for L2 relay.
* Proposal 4: For L2 U2N relay, cell ID can be used as additional AS criteria for relay (re)selection. RRC states under which the cell ID may be applied by L2 remote UE and how to use it by L2 remote UE are left to be addressed for L2 specific discussions. And the usage of cell ID by gNB for RRC CONNECTED L2 remote UE is handled by CP procedure and service continuity topic for L2 relay.
* Proposal 6: It is up to SA2 to decide how to include L2/L3 relay support in discovery message.
* Proposal 7: For RRC\_IDLE/INACTIVE L2 remote UE, the legacy cell (re)selection procedure and relay (re)selection procedure could go independently and up to UE implementation to select either cell or relay. For RRC\_CONNECTED L2 remote UE, it is handled by CP procedure and service continuity topic for L2 relay.
* [618]Leave to UE implementation whether to use SL-RSRP or SD-RSRP for relay reselection trigger evaluation in case of no data transmission from relay to remote.
* [618]Proposal 4[18/22][Easy]: Whether L2/L3 relay support can be used as additional criteria for relay (re-)selection can be left to SA2.
* [618]RAN2 do not specify a solution to the power imbalance issue for relay (re)selection in Rel-17.
* [618]RAN2 understand that the L2/L3 common parts of the relay discovery and (re)selection objectives are complete at stage 2 level from RAN2 perspective.

***Control plane procedures***

* [604]Proposal 5： [18/18][Easy]The Uu RLF indication from Relay UE may trigger the Remote UE connection re-establishment
* [604]Proposal 6： [18/18][Easy] The Remote UE may trigger the Remote UE connection re-establishment upon detecting PC5 RLF.
* [604]Proposal 8： [18/18][Easy]Confirm that for the OOC case, Remote UE with the RRC state of IDLE or INACTIVE should perform TAU/RNAU procedure
* [604]Proposal 9： [18/18][Easy]For IC Remote UE case, Remote UE performs TAU/RNAU based on its own serving cell information (i.e., as legacy) if it is NOT PC5-connected with Relay UE.
* [604]Proposal 13： [18/18][Easy] the Remote UE can receive the system information via PC5 after PC5 connection establishment with Relay UE.
* [604]Proposal 1： [14/18[Easy] RRC state combination of Relay UE in RRC\_IDLE and Remote UE in RRC\_INACTIVE is supported.
* [604]Proposal 7 (modified)： [16/17][Easy] The Remote UE may perform RRC re-establishment procedure as follows:

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

‒ If only suitable relay(s) are available, the Remote UE initiates RRC re-establishment procedure towards a suitable relay UE’s serving cell;

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

* [604]Proposal 11： [15/18][Easy]In case of Remote UE RRC resume to a new gNB, legacy Retrieve UE Context procedure is performed, i.e., the new gNB retrieves the Remote UE context for Remote UE.
* [604]Proposal 17： [17/18][Easy]When Relay UE in RRC IDLE/RRC INACTVE and Remote UE in RRC IDLE/RRC INACTIVE, the Relay UE monitors paging occasions of its PC5-RRC connected Remote UE(s)
* [604]Proposal 19： [17/18][Easy]When Relay UE in RRC CONNECTED and Remote UE in RRC CONNECTED, the Relay UE may monitor for SI change indication and/or PWS notifications in any PO as legacy.
* [604]Proposal 22： [15/18][Easy] A new PC5-RRC message is needed to relay the paging information from Relay UE to Remote UE for unicast.
* [604]Proposal 2： [16/18[Cross WG] RAN2 to send a LS to SA2/CT1 to ask their view on whether a new or existing establishment/resume cause value is used for Relay UE when Relay UE enters RRC\_CONNECTED only for relaying purpose.
* [604]Proposal 23： [17/18][Cross WG] Confirm the WA that Remote UE performs UAC based on legacy procedure and send a LS to SA2/CT1 to inform about RAN2 decision.

***Service Continuity***

* [605]Proposal 1 (easy) (19/19): The procedure of Figure 4.5.4.1-1 in TR38.836 and the procedure of Figure 4.5.4.2-1 in TR38.836 are the baseline for Remote UE’s intra gNB mobility in RRC\_CONNECTED.
* [605]Proposal 2 (easy) (19/19): INM RRC and/or X2/Xn messages for inter-gNB handover are not used for the path switch procedures in intra gNB case.
* [605]Proposal 3 (easy) (19/19): DAPS-like path switch procedure for Remote UE is not considered in this release.
* [605]Proposal 6 (easy) (19/19): Legacy RRC Reconfiguration and Measurement Report signalling procedures can be used for path switch procedure with extension to evaluate relay link measurement and Uu link measurement.
* [605]Proposal 10 (easy) (19/19): In case of path switch from indirect to direct, detailed measurement results from Remote UE are reported when configured reporting criteria is met as legacy measurement report.
* [605]Proposal 11 (easy) (19/19): SL relay measurement report can include at least Relay UE ID, serving cell ID, RSRP information.
* [605]Proposal 13 (easy) (19/19): Remote UE in RRC\_CONNECTED suspend Uu RLM when Remote UE is connected to gNB via Relay UE.
* [605]Proposal 14 (easy) (19/19): For indirect to direct path switch, Remote UE stops UP and CP transmission via relay link after reception of RRC Reconfiguration message from gNB (i.e., step 3).
* [605]Proposal 23 (easy) (19/19): For indirect to direct path switch, the timing of step 8 is independent of step 6 and step 7.

[Note: P23 refers to the step numbers from Figure 4.5.4-1 of TR 38.836]

* [605]Proposal 24 (easy) (19/19): For indirect to direct path switch, RLC and lower layers behaviours of a Remote UE can be similar with those of legacy UE in intra-gNB handover.
* [605]Proposal 29 (easy) (19/19): For direct to indirect path switch, Remote UE stops UP and CP transmission over Uu after reception of RRC Reconfiguration message from gNB (i.e., step 3).
* [605]Proposal 31 (easy) (19/19): For direct to indirect path switch, the contents in RRC Reconfiguration message for Remote UE can include at least Relay UE ID, PC5 RLC configuration for relaying and associated E2E RB.

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