**3GPP TSG-RAN WG3 Meeting #127 R3-25xxxx**

**Athens, Greece, 17 – 21 February 2025**

**Agenda Item: 22.2**

**Source: LG Electronics Inc., ZTE, Nokia, Nokia Shanghai Bell**

**Title: (TP for TS 38.401) Support of Multi-hop relay**

**Document for: Agreement**

# 1. Introduction

This document contains the TP for Multi-hop Relay BLCR for TS 38.401.

# 2. TP for TS 38.401

***----------------Start of the First Change---------------***

## 8.xx Overall procedures for Multi-hop Layer-2 UE-to-Network Relay

### 8.xx.1 Remote UE initial access

Editor’s Note: FFS where to capture the following procedure.

The signalling flow for Remote UE Initial access is shown in Figure 8.xx.1-1.



Figure 8.xx.1-1: Overall procedure for Remote UE’s initial access via multi-hop relay

1. The U2N Remote UE, the U2N First Relay UE, the U2N Intermediate Relay UE, and the U2N Last Relay UE perform discovery procedure, and establish PC5 connection using NR ProSe procedure.

2. The U2N Remote UE sends an *RRCSetupRequest* message to the U2N First Relay UE via PC5 Relay RLC channel.

3. The U2N First Relay UE withholds the received RRC message. If the U2N First Relay UE is in RRC\_IDLE/RRC\_INACTIVE state, it should send its own *RRCSetupRequest* message to the U2N Intermediate Relay UE via PC5 Relay RLC channel in order to trigger the RRC establishment/resume procedure to enter RRC\_CONNECTED state upon reception of the RRC message from the U2N Remote UE. If the U2N Intermediate Relay UE is in RRC\_IDLE/RRC\_INACTIVE state, it should trigger the RRC establishment/resume procedure in clause 8.19.1 to enter RRC\_CONNECTED state upon reception of the RRC message from the U2N First Relay UE. If all Relay UEs are in RRC\_CONNECTED state, this step could be skipped.

4. The U2N First Relay UE in RRC\_CONNECTED state sends the *SidelinkUEInformationNR* message to the gNB-DU via the Intermediate Relay UE and U2N Last Relay UE.

5. The gNB-DU sends the UL RRC MESSAGE TRANSFER message of the U2N First Relay UE by encapsulating the *SidelinkUEInformationNR* message to gNB-CU, and gNB-CU allocates the local ID of U2N Remote UE.

6. The gNB-CU sends the UE CONTEXT MODIFICATION REQUEST message of the U2N Last Relay UE to gNB-DU. Such message may request the establishment of Uu Relay RLC channel(s) and PC5 Relay RLC channel(s) for the transmission of U2N Remote UE’s SRB0.

7. The gNB-DU sends the UE CONTEXT MODIFICATION RESPONSE message of the U2N Last Relay UE to gNB-CU.

8. The gNB-CU sends the DL RRC MESSAGE TRANSFER message of the U2N Last Relay UE to gNB-DU by encapsulating the *RRCReconfiguration* message, which contains the local ID allocated to the U2N Remote UE. The *RRCReconfiguration* message shall also contain the Uu Relay RLC channel(s) configuration and PC5 Relay RLC channel(s) configuration if not configured and bearer mapping for relaying of U2N Remote UE’s SRB0.

9. The gNB-DU sends the *RRCReconfiguration* message to the U2N Last Relay UE to configure the local ID of the U2N Remote UE, the Uu Relay RLC channel(s) configuration, PC5 Relay RLC channel(s) configuration and bearer mapping for relaying of U2N Remote UE’s SRB0.

10. The U2N Last Relay UE sends the *RRCReconfigurationComplete* message to gNB-DU.

11. The gNB-DU sends the UL RRC MESSAGE TRANSFER message of the U2N Last Relay UE by encapsulating the *RRCReconfigurationComplete* message to gNB-CU.

12. The gNB-CU configures the U2N Intermediate Relay UE with the local ID allocated to the U2N Remote UE, PC5 Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB0. According to the configuration from gNB-CU, the U2N Intermediate Relay UE may establish a PC5 Relay RLC channel for relaying of U2N Remote UE’s SRB0 over PC5. This step follows the same signaling flow as described in steps 6-11.

13. The gNB-CU configures the U2N First Relay UE with the local ID allocated to the U2N Remote UE, PC5 Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB0. According to the configuration from gNB-CU, the U2N First Relay UE may establish a PC5 Relay RLC channel for relaying of U2N Remote UE’s SRB0 over PC5. This step follows the same signaling flow as described in steps 6-11.

Editor’s Note: FFS whether each Relay UE needs to establish new PC5/Uu RLC channel for a Remote UE.

Editor’s Note: FFS how/what information is used to indicate the counterpart information of a configured PC5 Relay RLC channel to the gNB-DU.

Editor’s Note: FFS how to configure relay UEs for relaying of remote UE’s SRB/data over F1, e.g. via separate procedures of each relay UE or via an single procedure for all relay UEs’ configuration.

14. After receiving the local ID of the U2N Remote UE and the PC5 Relay RLC channel(s) configuration and bearer mapping for relaying of U2N Remote UE’s SRB0, the U2N First Relay UE sends the *RRCSetupRequest* message of the U2N Remote UE to gNB-DU via the U2N Intermediate Relay UE and the U2N Last Relay UE. The local ID of the U2N Remote UE and RB ID for SRB0 are conveyed in the SRAP header.

15. The gNB-DU allocates a C-RNTI and a gNB-DU UE F1AP ID for the U2N Remote UE and sends the INITIAL UL RRC MESSAGE TRANSFER message to gNB-CU by encapsulating the *RRCSetupRequest* message of the U2N Remote UE. In addition, the local ID of the U2N Remote UE, the gNB-DU UE F1AP ID of the U2N Last Relay UE and the sidelink configuration container for the PC5 Relay RLC channel configuration for relaying of U2N Remote UE’s SRB1 are included in the INITIAL UL RRC MESSAGE TRANSFER message.

Editor’s Note: FFS whether the gNB-DU UE F1AP IDs of the U2N First Relay UE and the U2N Intermediate Relay UE are included in the INITIAL UL RRC MESSAGE TRANSFER message.

Editor’s Note: FFS whether and how the gNB-DU becomes aware that the U2N Remote UE is connected to the gNB-DU via the U2N First Relay UE, the U2N Intermediate Relay UE and U2N Last Relay UE.

16. The gNB-CU allocates a gNB-CU UE F1AP ID for the U2N Remote UE and generates a *RRCSetup* message towards the U2N Remote UE. The RRC message is encapsulated in the DL RRC MESSAGE TRANSFER message, and includes the configurations of PC5 Relay RLC channel and bearer mapping at least for the transmission of U2N Remote UE’s SRB1.

17. The gNB-DU sends the *RRCSetup* message to the U2N Remote UE via the U2N First Relay UE, the U2N Intermediate Relay UE and U2N Last Relay UE.

18. The gNB-CU configures the U2N Last Relay UE with PC5 Relay RLC channel, Uu Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB1. According to the configuration from gNB-CU, the U2N Last Relay UE establishes a PC5 Relay RLC channel for relaying of U2N Remote UE’s SRB1 over PC5 and establishes a Uu Relay RLC channel for relaying of U2N Remote UE’s SRB1 towards gNB-DU if not configured yet.

The gNB-CU configures the First Relay UE and the U2N Intermediate Relay UE with PC5 Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB1. According to the configuration from gNB-CU, the First Relay UE and the U2N Intermediate Relay UE establish the PC5 Relay RLC channels for relaying of U2N Remote UE’s SRB1 over PC5 if not configured yet.

Editor’s Note: FFS whether Step 18 can be performed earlier, e.g., via Steps 6-13.

19. The U2N Remote UE sends the *RRCSetupComplete* message to the gNB-DU via the U2N First Relay UE, the U2N Intermediate Relay UE and U2N Last Relay UE.

20. The gNB-DU encapsulates the RRC message in the UL RRC MESSAGE TRANSFER message and sends it to the gNB-CU.

21. Upon receiving the *RRCSetupComplete* message of U2N Remote UE, the gNB-CU sends the INITIAL UE MESSAGE message to the AMF.

22. The AMF sends the INITIAL CONTEXT SETUP REQUEST message to the gNB-CU.

23. The gNB-CU sends the UE CONTEXT SETUP REQUEST message to establish the U2N Remote UE context in the gNB-DU. Such message may request the configuration of PC5 Relay RLC channels for the transmission of U2N Remote UE’s SRB2 and DRBs, and may also encapsulate the *SecurityModeCommand* message.

24. The gNB-DU sends the *SecurityModeCommand* message to the U2N Remote UE via the U2N First Relay UE, the U2N Intermediate Relay UE and U2N Last Relay UE.

25. The gNB-DU sends the UE CONTEXT SETUP RESPONSE message of the U2N Remote UE to the gNB-CU, which contains the configuration of PC5 Relay RLC channels for the transmission of U2N Remote UE’s SRB2 and DRBs.

26. The U2N Remote UE responds with the *SecurityModeComplete* message.

27. The gNB-DU encapsulates the RRC message in the UL RRC MESSAGE TRANSFER message and sends it to the gNB-CU.

28. The gNB-CU generates the *RRCReconfiguration* message for U2N Remote UE and encapsulates it in the DL RRC MESSAGE TRANSFER message. The *RRCReconfiguration* message contains the configuration of PC5 Relay RLC channels and bearer mapping for the transmission of U2N Remote UE’s SRB2 and DRBs.

29. The gNB-DU sends *RRCReconfiguration* message to the U2N Remote UE via the U2N First Relay UE, the U2N Intermediate Relay UE and U2N Last Relay UE.

30. The U2N Remote UE sends *RRCReconfigurationComplete* message to the gNB-DU via the U2N First Relay UE, the U2N Intermediate Relay UE and U2N Last Relay UE.

31. The gNB-DU encapsulates the RRC message in the UL RRC MESSAGE TRANSFER message and send it to the gNB-CU.

32. The gNB-CU sends the INITIAL CONTEXT SETUP RESPONSE message to the AMF.

33. The gNB-CU configures additional Uu Relay RLC channels between the gNB-DU and the U2N Last Relay UE, and additional PC5 Relay RLC channels for the U2N First Relay UE, the U2N Intermediate Relay UE, and the U2N Last Relay UE for relaying of U2N Remote UE’s DRBs and SRBs. Also, such step may configure the bearer mapping between U2N Remote UE’s DRB/SRB and PC5/Uu Relay RLC channel at the U2N First Relay UE, the U2N Intermediate Relay UE, and the U2N Last Relay UE.

Editor’s Note: FFS whether this step can be performed earlier.

***-----------------End of the First Change---------------***