**3GPP TSG-RAN WG4 Meeting # 109 R4-23XXXXX**

**Chicago, USA, November 13 – November 17, 2023**

**Agenda item:** 8.32.3

**Source:** Moderator (LG Electronics)

**Title:** Topic summary for [109][232] NR\_SL\_relay\_enh

**Document for:** Information

# Introduction

*This document is the topic summary for [109][232] NR\_SL\_relay\_enh. The lists of open issues are as follow:*

* Topic1: RRM core requirements
	+ Sub-topic1-1: Whether and how to capture the interruption requirement for remote UE due to the SL-DRX operation in multipath relay scenario
	+ Sub-topic1-2: CRs
* Topic2: RRM performance requirements
	+ Sub-topic2-1: Work Plan
	+ Sub-topic2-2: RRM performance requirements for R18 sidelink relay UE
	+ Sub-topic2-3: CRs

*The recommendation of issues for online discussion:*

* **Issue 1-1-1**: Whether to capture the interruption requirement for remote UE due to the SL-DRX operation in multipath relay scenario or not
* **Issue 1-1-2**: How to capture the interruption requirement for remote UE due to the SL-DRX operation in multipath relay scenario if necessary
* **Issue 2-1-1**: Work Plan
* **Issue 2-2-1**: RRM performance requirements for R18 sidelink relay UE
* **Issue 2-2-2**: Test cases and scenarios for R18 sidelink relay UE
* **Issue 2-2-3**: Test case for delay of selection/reselection of relay UE by remote UE in U2U relay scenario
* **Issue 2-2-5**: Test cases for interruptions caused by remote UE in multi-path relay scenario

# Topic #1: RRM core requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2319387 | LGE | ***Proposal 1:*** RAN4 to capture “the interruptions to WAN at transitions between active and non-active during SL-DRX in multi-path relay scenario” |
| R4-2319633 | MTK | **Observation 1: Legacy interruption requirements due to SL-DRX operation defined in R17 are applicable to R17 remote UE as the scenarios remote UE in coverage or not are all considered in R17 SL relay.****Proposal 1: No need to define new interruption requirements for remote UE due to SL-DRX operation. The legacy requirements apply.** |
| R4-2320689 | Ericsson | **Interruptions in Rel-17 U2N relay scenario:*** **Observation #1**: According to clause 4.1 in TS 38.304, the remote UE in U2N scenario acquires all the SI and paging only via the relay UE i.e. when the remote UE has U2N relay path wrt the serving cell
* **Observation #2**: According to clause 5.2.1 in TS 38.304, the remote UE can select either a cell or a relay UE for all the idle mode tasks e.g. for acquiring the SI, paging etc.
* **Observation #3**: If the remote UE selects a cell instead of the relay UE then the remote UE will NOT be operating in U2N relay scenario.
* **Observation #4**: The remote UE upon selecting a cell (instead of the relay UE) behaves like a normal/legacy UE following the the cell selection/reselection procedures and meeting the corresponding requirements e.g. in clauses 4.1 and 4.2 of TS 38.133.
* **Observation #5**: According to RAN2 specifications, the remote UE in U2N scenario is NOT required to simultaneously maintain the two connections/links i.e. the direct connection with its serving cell in RRC idle state and the indirect connection with its serving cell via relay UE
* **Proposal #1**: The remote UE while operating in U2N relay scenario does NOT cause any interruption to its serving cell.
* **Proposal #2**: The interruption requirements in clause 12.7.4 in TS 38.133, Rel-17, apply ONLY to the relay UE in U2N scenario i.e. when the remote UE has connection to its serving cell via relay UE.

**Interruptions in multi-path relay scenario:*** **Observation #6**: It has been agreed that the remote UE can cause interruption on its serving cell due to the SL DRX operation in multipath scenario.
* **Observation #6**: However, the existing interruption requirements in clause 12.7.4 in TS 38.133 due to the SL DRX operation are NOT applicable to the remote UE in multipath relay scenario.
* **Proposal #3**: Explicitly define requirements on interruptions caused by the remote UE on its serving cell of the direct path due to the SL-DRX operation while in multipath relay operation i.e. when simultaneously maintaining direct path connection with a servng cell and an indirect path connection via relay UE with the same or another servng cell.
* **Proposal #3**: The interruption requirements (in terms of interruption probabilities and interruption length) on the remote UE due to the SL-DRX operation in the multipath scenario are reused from clause 12.7.4 of TS 38.133; but are defined in new clause for clarity and to prevent misinterpretation.
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| R4-2320690 | Ericsson | Draft CR on delay requirements for U2U relay operation |
| R4-2320691 | Ericsson | Draft CR on interruption requirements for multipath relay operation under SL-DRX |
| R4-2320865 | Nokia | 1. Current specifications on interruption requirements caused by the remote UE on its serving cell in TS 38.133 are applicable to multipath without modification or adding a new section.
2. RAN4 not to add a new section to clarify interruption requirements caused by the remote UE on serving cell in multipath scenario.
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| R4-2318939 | Qualcomm | **Proposal: Do not add new clauses for multi-path relay scenarios. If the need of the specification change on RRC configuration related interruption is identified based on the previous meeting WF, we have the following proposals for text change*** **We propose to add applicability description in the end of the existing clauses:**
	+ **12.7,8: The requirement in this clause is applicable to multipath relay scenario**

**If clarification on DRx related interruption requirements is needed, we propose the following revision:*** **In 12.7.4:**

The requirement in this clause is applicable to the interruptions on the PCell/serving cell on the direct path caused by a remote UE due to transitions between active and non-active times during SL-DRX in multi-path relay scenario [2]" |

## Open issues summary

### Sub-topic 1-1 Whether and how to capture the interruption requirement for remote UE due to the SL-DRX operation in multipath relay scenario

*This sub-topic is for whether and how to capture the interruption requirement for remote UE due to the SL-DRX operation in multipath relay scenario*

*Open issues and candidate options before meeting:*

**Issue 1-1-1: Whether to capture the interruption requirement for remote UE due to the SL-DRX operation in multipath relay scenario or not**

* Proposals
	+ Option 1: No need to define new interruption requirements for remote UE due to SL-DRX operation. The legacy requirements apply. (MTK, Nokia)
	+ Option 2: Explicitly define requirements on interruptions caused by the remote UE on its serving cell of the direct path due to the SL-DRX operation while in multipath relay operation. (Ericsson, LGE)
		- The remote UE while operating in U2N relay scenario does NOT cause any interruption to its serving cell.
		- The interruption requirements in clause 12.7.4 in TS 38.133, Rel-17, apply ONLY to the relay UE in U2N scenario i.e. when the remote UE has connection to its serving cell via relay UE.
* Recommended WF
	+ Moderator’s view: Need further discussion with focusing on Rel-17 applicability scenario. Whether the Rel-17 U2N scenario covered the remote UE’s direct path or not.

**Issue 1-1-2: How to capture the interruption requirement for remote UE due to the SL-DRX operation in multipath relay scenario if necessary**

* Proposals
	+ Option 1: The interruption requirements (in terms of interruption probabilities and interruption length) on the remote UE due to the SL-DRX operation in the multipath scenario are reused from clause 12.7.4 of TS 38.133; but are defined in new clause for clarity and to prevent misinterpretation. (Ericsson)
	+ Option 2: RAN4 not to add a new section to clarify interruption requirements caused by the remote UE on serving cell in multipath scenario. (Nokia)
	+ Option 2A: (Qualcomm)
		- Do not add new clauses for multi-path relay scenarios. If the need of the specification change on RRC configuration related interruption is identified based on the previous meeting WF, we have the following proposals for text change
			* We propose to add applicability description in the end of the existing clauses:
				+ 12.7.8: The requirement in this clause is applicable to multipath relay scenario
			* If clarification on DRx related interruption requirements is needed, we propose the following revision:
				+ 12.7.4: The requirement in this clause is applicable to the interruptions on the PCell/serving cell on the direct path caused by a remote UE due to transitions between active and non-active times during SL-DRX in multi-path relay scenario
* Recommended WF
	+ Moderator’s view: This issue depends on issue 1-1-1. If agreed option 2 of Issue 1-1-1, then can be discussed further how to capture the interruption requirement. Else Issue 1-1-2 does not need to discuss anymore.

### Sub-topic 1-2 CRs

*This sub-topic is for Draft CR of core requirements*

*Open issues and candidate options before meeting:*

**Issue 1-2-1: Draft CRs for NR\_SL\_relay\_enh RRM core requirements**

* Proposals
	+ R4-2320690 Draft CR on delay requirements for U2U relay operation
	+ R4-2320691 Draft CR on interruption requirements for multipath relay operation under SL-DRX
* Recommended WF
	+ Moderator’s view: The contents of R4-2320690 is already endorsed at last 108bis meeting. So, R4-2320690 is agreeable. Regarding R4-2320691, it will updated by conclusions of the open issues issue 1-1-1 and issue 1-1-2.

# Topic #2: RRM performance requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2319401 | LGE | ***Proposal 1:*** Current spec. could not cover multipath scenario. So, the applicability update for multipath scenario is necessary (Support Option 1). ***Proposal 2:***  Define test cases to verify the following core requirements:1. Delay of selection/reselection of relay UE in UE-to-UE relay scenario
2. Interruptions in multi-path relay scenario:
3. Interruption requirements caused by the remote UE on its serving cell due to the SL DRX operation between itself and the relay UE.
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| R4-2319402 | LGE | ***Proposal 1***: Approve the work plan on RRM performance part of Rel-18 NR sidelink relay.  |
| R4-2320692 | Ericsson | **SD-RSRP and SL-RSRP accuracies in multi-path scenario:*** **Observation #1**: The remote UE in multipath scenario will use the existing physical signals to perform the SD-RSRP and SL-RSRP measurements on signals transmitted by the relay UE on the indirect path (i..e. on the U2N relay path).
* **Observation #2**: The remote UE may be configured to operate on both paths (direct path and SL relay path) either on the same frequency or on different frequencies:
	+ In the first scenario the remote UE is still in coverage via direct path on the same frequency which is also used for the SL on indirect path (i.e. U2N.
	+ In the second scenario it can be assumed that the UE is out of coverage on the freqency used for the SL on the indirect path.
* **Proposal #1**: Existing accuracies of SD-RSRP and SL-RSRP in clause 10.4.5 shall also apply for the remote UE in the multipath scenario provided that the remote UE:
	+ is synchronised to the sidelink relay UE that is measured and
	+ is in-coverage on the frequency used for sidelink if both the direct path and the SL on the indirect path are on the same frequency or
	+ is out of coverage on the frequency used for sidelink if the direct path and the SL on the indirect path are on different frequencies.

**Test cases for SL relay enhancements:*** **Proposal #2**: Define test cases to verify the following core requirements:
1. Delay of selection/reselection of relay UE in U2U relay scenario
2. Interruptions caused by the remote UE and relay UE due to the SL DRX operation between the remote UE and the relay UE in multi-path relay scenario.
3. Interruption requirements caused by the remote UE on its serving cell due to the SL DRX operation between itself and the relay UE.

**Test case for delay of selection/reselection of relay UE by remote UE in U2U relay scenario:*** **Proposal #3**: To verify the selection/reselection of relay UE in UE-to-UE relay scenario, reuse the methodology in test case in clause A.9.1.7 (Selection / Reselection of relay UE) by modelling a remote UE (UE1), a relay UE (UE2) and a target/destination UE (UE3).
* **Proposal #4**: To limit testing, define an applicability rule in annex A of TS 38.13, that the UE capable of both U2U relay and U2N relay operations is required to pass only one of the two test cases: under U2U scenario or U2N relay scenario.

**Test cases for interruptions caused by remote UE in multi-path relay scenario:*** **Proposal #5**: To verify the interruption requirements caused by the remote UE on its serving cell and the relay UE on its serving cell due to the transitions between the active and non-active times of the SL DRX in multipath scenario, reuse the methodology in test case in clause A.9.1.6.2 (Test for interruption to WAN at transitions between active and non-active during SL-DRX in asynchronous case) by configuring the remote UE (UE1) and the relay UE (UE2) served by different cells (Cell1 and Cell2 respectively) on different carrier frequencies.
	+ The purpose of the test shall be to verify the interruption caused on the serving cell (Cell1) (direct path) by the remote UE and interruption caused on the serving cell (Cell2) (indirect path) by the relay UE do not exceed the required limit while there are transitions between active and non-active times during the SL-DRX (between the remote UE and relay UE on the indirect path).
* **Proposal #6**: To limit testing, define an applicability rule in annex A of TS 38.13, that the UE capable of both multipath relay and U2N relay operations is required to pass only the test case in multipath operation.
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| R4-2320693 | Ericsson | Draft CR on applicability of SD-RSRP and SL-RSRP accuracy requirements in multipath scenario |
| R4-2320866 | Nokia | 1. There is no need to introduce new RRM performance requirements for R18 sidelink relay UE.
2. Existing test setup for U2N relay (re)selection should be used as the baseline for the test cases for U2U relays consisting of the five time periods from T1 to T5.
3. For adaptation to U2U relays, the description on ‘the RSRP of the serving cell’ should be replaced with ‘the RSRP of the direct link between the source and target remote UE.’ A new threshold for transition from direct to indirect path may be adopted.
4. Test requirements from Clause A.9.1.7.2 shall be used for U2U relay scenario with the assumption that the remote UE, U2U relay UE, and the target UE are out of coverage.
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## Open issues summary

### Sub-topic 2-1 Work Plan

*Sub-topic description: Work plan for NR\_SL\_relay\_enh RRM performance*

**Issue 2-1-1: Work Plan**

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| **Meeting** | **Works** |
| RAN4#109(Nov.2023) | * Discussion and approvement on work plan
* Initial discussion on the list of test cases
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| RAN4#110(Feb.2024) | * Discussion and finalization on the list of test cases
* Discussion and finalization of CR work split
 |
| RAN4#110-bis(Apr.2024) | * Initial draft CR submission
* Discussion on remaining issues
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| RAN4#111(May.2024) | * Discussion and conclusion on remaining issues
* Agreement on final CRs
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* Recommended WF
	+ Moderator’s view: Need to discuss and approve work plan.

### Sub-topic 2-2 RRM performance requirements for R18 sidelink relay UE

*This sub-topic is for RRM performance requirements for R18 sidelink relay UE*

*Open issues and candidate options before meeting:*

**Issue 2-2-1: RRM performance requirements for R18 sidelink relay UE**

* Proposals
	+ Option 1: There is no need to introduce new RRM performance requirements for R18 sidelink relay UE. (Nokia)
	+ Option 2 (Ericsson, LGE):
		- Existing accuracies of SD-RSRP and SL-RSRP in clause 10.4.5 shall also apply for the remote UE in the multipath scenario provided that the remote UE:
			* is synchronised to the sidelink relay UE that is measured and
			* is in-coverage on the frequency used for sidelink if both the direct path and the SL on the indirect path are on the same frequency or
			* is out of coverage on the frequency used for sidelink if the direct path and the SL on the indirect path are on different frequencies.
* Recommended WF
	+ Moderator’s view: This issue is not for RRM performance requirements, just applicability description. And it can be necessary to cover the multipath scenario. So, we would like for companies to check whether option2 is agreeable.

**Issue 2-2-2: Test cases and scenarios for R18 sidelink relay UE**

* Proposals
	+ Option 1: no need to introduce new RRM test cases.(HW)
	+ Option 2: Define test cases to verify the following core requirements: (Ericsson, LGE)
		- Delay of selection/reselection of relay UE in U2U relay scenario
		- Interruptions caused by the remote UE and relay UE due to the SL DRX operation between the remote UE and the relay UE in multi-path relay scenario.
			* Interruption requirements caused by the remote UE on its serving cell due to the SL DRX operation between itself and the relay UE.
* Recommended WF
	+ Moderator’s view: Need further discussion. This issue depends on the results of core requirement open issues.

**Issue 2-2-3: Test case for delay of selection/reselection of relay UE by remote UE in U2U relay scenario**

* Proposals
	+ Option 1: Existing test setup for U2N relay (re)selection should be used as the baseline for the test cases for U2U relays consisting of the five time periods from T1 to T5. (Nokia)
		- For adaptation to U2U relays, description on “the RSRP of the serving cell” should be replaced with “the RSRP of the direct link between the source and target remote UE”. And a new threshold for transition from direct to indirect path may be adopted.
		- Test requirements from Clause A.9.1.7.2 shall be used for U2U relay scenario with the assumption that the remote UE, U2U relay UE, and the target UE are out of coverage.
	+ Option 2: (Ericsson)
		- To verify the selection/reselection of relay UE in UE-to-UE relay scenario, reuse the methodology in test case in clause A.9.1.7 (Selection / Reselection of relay UE) by modelling a remote UE (UE1), a relay UE (UE2) and a target/destination UE (UE3).
* Recommended WF
	+ Moderator’s view: Both options show similar views. So, they can compromise to one of them.

**Issue 2-2-4: Applicability rule for delay of (re)selection of relay UE by remote UE**

* Proposals
	+ Option 1: To limit testing, define an applicability rule in annex A of TS 38.133, that the UE capable of both U2U relay and U2N relay operations is required to pass only one of the two test cases: under U2U scenario or U2N relay scenario. (Ericsson)
* Recommended WF
	+ Moderator’s view: Need further discussion.

**Issue 2-2-5: Test cases for interruptions caused by remote UE in multi-path relay scenario**

* Proposals
	+ Option 1: To verify the interruption requirements caused by the remote UE on its serving cell and the relay UE on its serving cell due to the transitions between the active and non-active times of the SL DRX in multipath scenario, reuse the methodology in test case in clause A.9.1.6.2 (Test for interruption to WAN at transitions between active and non-active during SL-DRX in asynchronous case) by configuring the remote UE (UE1) and the relay UE (UE2) served by different cells (Cell1 and Cell2 respectively) on different carrier frequencies. (Ericsson)
		- The purpose of the test shall be to verify the interruption caused on the serving cell (Cell1) (direct path) by the remote UE and interruption caused on the serving cell (Cell2) (indirect path) by the relay UE do not exceed the required limit while there are transitions between active and non-active times during the SL-DRX (between the remote UE and relay UE on the indirect path).
* Recommended WF
	+ Moderator’s view: Need further discussion.

**Issue 2-2-6: Applicability rule for interruptions caused by the remote UE and the relay UE on their serving cells due to the transitions between the active and non-active times of the SL DRX**

* Proposals
	+ Option 1: To limit testing, define an applicability rule in annex A of TS 38.133, that the UE capable of both multipath relay and U2N relay operations is required to pass only the test case in multipath operation. (Ericsson)
* Recommended WF
	+ Moderator’s view: Need further discussion.

### Sub-topic 2-3 CRs

**Issue 2-3-1: Draft CRs for NR\_SL\_relay\_enh RRM performance requirements**

* Proposals
	+ R4-2320693 Draft CR on applicability of SD-RSRP and SL-RSRP accuracy requirements.
* Recommended WF
	+ Moderator’s view: Need further discussion.