3GPP TSG RAN WG1 #112bis-e R1-23XXXXX

e-Meeting, April 17th - April 26th, 2023

**Source: Moderator(Nokia)**

**Title:** **Summary#1 - [112bis-e-R18-SL-05] Email discussion on RAN2 LS on comparison of SL-RSRP and SD-RSRP measurements in R1-2302280**

**Agenda item: 9.4**

**Document for: Discussion**

# Introduction

This document provides the summary of the following email discussion:

[112bis-e-R18-SL-05] Email discussion on RAN2 LS on comparison of SL-RSRP and SD-RSRP measurements in [R1-2302280](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302280.zip) by April 26 – Torsten (Nokia)

# Background

In their LS on Comparison of SL-RSRP and SD-RSRP measurements [1], RAN2 pose the following question:

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| **Q1:** Can the comparison of SL-RSRP and SD-RSRP measurement be used for the purposes of triggering a measurement report? |

RAN2 discussed introducing the following measurement event:

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| Event Z2: The measured RSRP of a candidate L2 U2N Relay UE becomes an offset better than measured RSRP of the serving L2 U2N Relay UE |

The purpose is presumably to provide relevant measurement results to the gNB to assist the gNB in deciding whether to perform “indirect-to-indirect path switching”, that is replacing the current serving relay UE with a “better” relay UE. In the context of this measurement event, the issue at hand is whether comparing a measured SD-RSRP from a candidate relay UE to a measured SL-RSRP of the serving relay UE can be used to trigger such an event. The LS explains these two measurements as follows:

* SD-RSRP (RSRP measurement on broadcast PC5 link used for discovery messages)
* SL-RSRP (RSRP measurement on unicast PC5 link)

# Discussion

A UE may use different TX power for transmissions over which SL-RSRP is measured versus transmissions of discovery messages, over which SD-RSRP is measured, e.g.

## Round 1

### Q1

Q1: The submitted contributions identified the following factors which may result in measuring different levels of SL-RSRP and SD-RSRP even for the same relay UE.

Do you agree that RAN1’s reply should list such factors? **Yes/No**

If yes, **which of the following** should be included in RAN1’s reply to RAN2?

1. Unicast is subject to transmit power control based on SL pathloss if parameter *sl-P0-PSSCH-PSCCH* is provided, while broadcast is not subject to this power control mechanism.
2. Due to CBR-based power control, if configured, transmit power may depend on the priority of the transmission. The priority for discovery messages may be different from the priority used for the transmissions over which SL-RSRP is measured.
3. Transmission of discovery messages can take place in dedicated discovery pools; these may be configured differently, e.g. with respect to power control settings, from the pool(s) on which SL-RSRP is measured.
4. A TX UE may apply different beamforming to unicast and broadcast transmissions
5. Any others?

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| **Company** | **Yes/No** | **Which options to include (1,2,3,4,..)?** | **Comments** |
| ZTE | **Yes** | **1, 2,3,4,** | **In Option 2, to be more precise, we should say the maximum transmit power may depend on the priority of the transmission, and this would impact the actual transmit power.** |
| Intel | Yes | 1/2/3/4 | RAN1 should indeed highlight in the reply that all these factors result in measuring different levels of SL-RSRP and SD-RSRP even for the same relay UE, making these two incomparable. |
| vivo | Yes | 1/2/3/4 | It would be helpful for RAN2 to know why and when the direct comparison between SL-RSRP and SD-RSRP is not meaningful, so as to make the decision. |
| Apple | Yes | 1/2/3 | We can follow the majority view on Option 4. |
| Huawei, HiSilicon | Yes | 1,2,3 | It is reasonable that RAN1 provides factors that affect such RSRP measurement for communication and discovery messages, so that RAN2 can have sufficient information on how to proceed on their future work.  On #4, TX beamforming is not specified in Rel-16/17 NR SL, and is out of scope to be considered. |
| NEC | Yes | 1,2,3 |  |
| OPPO | Yes | 1/2/3 | Similar view with Apple/Huawei/HiSi/NEC that beamforming is not included in the reply. |
| Xiaomi | Yes | 1,2,3 | Beamforming shall not be included as it has not been specified. |
| Qualcomm |  | Prefer none, but if issues are included, then all. | Overall, we prefer to directly answer the question without additional details. RAN2 has already identified issues related to power control in the LS. The potential solution in the LS of the network applying an offset does not work in our view since there the network lacks information necessary to apply an offset.  For #2, the issue is not only the priority but also that power levels should be configured to be the same as well. This is very restrictive as likely the configuration would be different to address the different needs and traffic loads of discovery vs. communications.  One additional issue is the potential impact of SL CA on transmit power. LTE SL CA procedure requires the UE to reduce transmit power until PCmax is met, leaving details up to UE implementation. Given the instructions in the WID to reuse LTE SL CA mechanism, a similar approach is likely to be adopted for NR SL CA.  Lastly, it is not feasible for the network to know which mechanism affected transmission power for a specific transmission in many cases. |
| InterDigital | **No** | **Only 1, 2, and 3 lead to different levels, but the network can compensate for them.** | For 1, the network can determine the sidelink pathloss or not configure transmit power control.  For 2, the network is aware of the CBR, and therefore the compensation on the transmit power.  For 3, the network is aware of the difference in power control settings between the different pools  For 4, this is relevant only to FR2  Given the network can be aware of/control the differences in transmit power between SL-RSRP and SD-RSRP, these factors should not affect whether it is possible for the network to properly configure such event. An appropriate offset can be configured for the network depending on which measure is being compared. |

### Q2

Q2: To explicitly answer RAN2’s question

* Alt1: Reply - No, the comparison of SL-RSRP and SD-RSRP measurement cannot be used for the purposes of triggering a measurement report
* Alt2: Reply - If RAN2 can address the differences agreed in Q1 then the comparison of SL-RSRP and SD-RSRP measurement can be used for the purposes of triggering a measurement report
* Alt3: Reply - Yes, the network can configure a suitable offset value for event Z2 so that the comparison of SL-RSRP and SD-RSRP measurement can be used for the purposes of triggering a measurement report
* Alt4: Request further information from RAN2. If so, which exact information?
* Alt5: RAN1 does not explicitly answer RAN2’s question.
* Alt6: Any others?

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| **Company** | **Alternative(s)** | **Comments** |
| ZTE | **Alt 1** | **Please kindly capture our views in R1-2303396 in the conclusion part.** |
| Intel | Alt1 | Considering Q1, we do not believe such comparison is possible or feasible. |
| vivo | Alt2 w/ comments | In our view the decision should be taken by RAN2, not RAN1.  Technically speaking, all the factors listed in Q1 may be addressed in some ways (although may be not very typical). For example, at least from RAN1 perspective, the operator can disable SL OLPC to address the 1st issue, configure the same max Tx power for all the CBR level to address the 2nd issue, and does not operate in a separate discovery pool nor in a FR2 band to avoid the 3rd and 4th issues. RAN2 may have other solutions or considerations on these issues.  Therefore, we think it is reasonable to provide the issue list observed by RAN1 (as in Q1), and leave the decision to RAN2. |
| Apple | Alt 1 |  |
| Huawei, HiSilicon | Either Alt 2 or Alt 5. | RAN1 does not need to discuss/decide solution for this, RAN1 only needs to tell RAN2 the technical design details (i.e., Q1 part).  Whether there is solution to compensate factors listed in Q1 for the measurement event, should be up to RAN2. With Q1 provided, RAN2 can take actions accordingly. |
| NEC | Alt.2 / 3 | In Q1, RAN1 has provided RAN2 the factors that impacting the comparison of SL-RSRP and SD-RSRP. Therefore, in Q2, if RAN2 can address the impacts from the factors, the reply should be Alt.2/3 to leave RAN2 to make final decision but not RAN1. |
| OPPO | Alt 1 | From RAN1’s perspective, the comparison is unfeasible. |
| Xiaomi | Alt. 2/3 | We share the view of vivo and HW. |
| Qualcomm | Alt 1 | We support Alt 1. It directly answers the yes/no question asked by RAN2 in the LS. If RAN2 did not want a yes/no answer, they would have asked for a list of issue instead.  We do not think Alt 2 is feasible at this point. As we mentioned in our reply to Q1, SL CA design is unknown at this point, but will likely also impact transmission power. Other issues could be identified later as well.  Resolving all issues mentioned in Q1, if feasible, effectively amounts to disabling most power control features, which is undesirable in our view.  We disagree with the arguments for selecting Alt 5 and are unclear on how it would help RAN2, which explicitly asked RAN1 a yes/no question. |
| InterDigital | Alt3/Alt2 | The network is aware or can control the difference in SL-RSRP and SD-RSRP caused by each factors 1, 2, 3 in Q1. We can tell RAN2 that comparison is possible as long as the network configures an appropriate offset for event Z2.  Alt2 can be acceptable as long as the LS text clearly answer the question Q1 (whether it is feasible or not to compare SL-RSRP and SD-RSRP with an appropriate offset) |

# Conclusion

# Company views expressed in contributions

## Replies to RAN2’s question proposed in contributions

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| [R1-2302445](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302445.zip) | Vivo | In RAN1’s view, at least when the following conditions are met:   1. SL discovery message and normal SL PSSCH transmission are transmitted in the same pool, 2. the (pre-)configured open loop power control parameters are aligned between SL discovery message and normal SL PSSCH transmission, 3. SL pathloss based power control is disabled,   In this case, the comparison of SL-RSRP and SD-RSRP measurement is meaningful and can be used to trigger a measurement report. In other cases, it is not guaranteed that the measurement report would work as expected. For example, due to the SL pathloss based power control mechanism for unicast PSCCH transmission, the measurement result of the serving UE’s SL-RSRP may be lower than that of SD-RSRP. Consequently, if SL-RSRP is used for event trigging, the event Z2 may be triggered more frequently based on SL-RSRP than SD-RSRP. |
| [R1-2302526](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302526.zip) | OPPO | From RAN1’s perspective, it is not supported for the comparison of SL-RSRP and SD-RSRP measurement be used for the purposes of triggering a measurement report. |
| [R1-2302778](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302778.zip) | Intel | It is our understanding that comparison between SL-RSRP and SD-RSRP has several issues. Considering the LS from SA2 [2], the L2 IDs of remote UE and relay UE are different between the serving relay UE’s communication message (based on which SL-RSRP is measured) and discovery message (based on which SD-RSRP is measured), so it is unclear how the remote UE can compare the measurements from the two relay UEs. Furthermore, since a different power control mechanism may be applied on each PC5 unicast link, and since relay may belong to different cells, with current framework it is also unclear how to possibly compensate for different power allocation during the comparison given also that gNB may effectively not know if the reported value is SL-RSRP or SD-RSRP. With no additional details and considering the aforementioned issues, we think the *event Z2* may be practically unfeasible. |
| [R1-2302824](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302824.zip) | InterDigital, Inc. | *From RAN1 perspective:*   * *if the target relay UE is in RRC\_CONNECTED, comparison is possible for the purposes of triggering a measurement report as the network can determine an appropriate offset in the trigger from knowledge of the Uu path loss of the source and target relay UEs and the SL path loss between source and remote UE.* * *if the target relay UE is in RRC\_IDLE/RRC\_INACTIVE, comparison can be performed within an error range that is known to the network because the network can configure the range of possible Uu path loss of the target relay UE for transmission of the discovery.* |
| [R1-2302921](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302921.zip) | LG Electronics | From the perspective of RAN1, for the indirect-to-indirect path switch procedure, there is no strong technical motivation to newly define the measurement reporting event using the comparison of SL-RSRP and SD-RSRP measurements other than the Event Z1. |
| [R1-2303321](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303321.zip) | Ericsson | According to TS 138 300 V17.3.0, for service continuity of L2 U2N Relay, during the L2 U2N Remote UE switching to direct path, 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. However, it is not straightforward to establish one-to-one mapping between SL-RSRP and SD-RSRP given that there exist power control and beamforming, etc., on the UE-to-UE link. Note that the network is not aware of the power control or beamforming parameters. |
| [R1-2303371](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303371.zip) | MediaTek Inc. | It should be clarified by RAN2 at first the criterion on the comparison between SL-RSRP and SD-RSRP. |
| [R1-2303396](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303396.zip) | ZTE, Sanechips | Following RAN1’s spec in TS38.213, based on high layer configuration, for groupcast/broadcast transmission, only DL pass loss based power control can be applied, while for unicast transmission, any one or both of DL pass loss based and SL pass loss based power control can be applied on one unicast link. The RSRP measurement based on unicast transmissions if SL pass loss based power control is applied, e.g. above-mentioned SL-RSRP in Q1, as an outcome, will be significantly different with the RSRP measurement based on groupcast/broadcast transmissions, e.g. above-mentioned SD-RSRP in Q1. Moreover, neither DL nor SL pathloss of each SL UE is available at the network and there is no means to derive any offset to compensate the RSRP measurement difference. Thus, the comparison of SL-RSRP and SD-RSRP measurement **cannot** be used for the purposes of triggering such measurement report. |
| [R1-2303466](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303466.zip) | Apple | No, the comparison of SL-RSRP and SD-RSRP measurements cannot be used for the purpose of triggering a measurement report. |
| R1- 2303559 | Qualcomm | No, from RAN1’s perspective, the comparison of SL-RSRP and SD-RSRP measurement cannot be used for the purposes of triggering a measurement report. It is not feasible for the network or a receiver UE to know whether a certain measured SL-RSRP value was affected by sidelink pathloss based power control, downlink pathloss based power control, congestion control, only the pathloss between the transmitter and receiver, or a combination of these items. |
| [R1-2303646](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303646.zip) | Xiaomi | Yes. The comparison can be used for the purpose of triggering a measurement report.  Sidelink based open loop power control has been supported for unicast, but not for broadcast. Therefore, the transmit power of the serving relay UE and the candidate relay UE can be different. If sidelink based open loop power control is used, the dependency of SL RSRP measurement result on pathloss will be reduced.  However, the power control parameters of serving relay UE are configured by the network. The network can take this intro account and can still set a suitable offset value to trigger the measurement report. |
| [R1-2303857](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303857.zip) | Huawei, HiSilicon | *The comparison of SL-RSRP and SD-RSRP measurement can be used for the purposes of triggering a measurement report, if RAN2 can address the difference between transmission power for PSSCH carrying communication and discovery messages due to different priority,* , *, and subject to or not.* |
| [R1-2303874](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303874.zip) | Nokia, Nokia Shanghai Bell | A direct comparison of SL-RSRP and SD-RSRP is not meaningful. |

## Conclusions in discussion tdocs

### [R1-2302525](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302525.zip) OPPO

In this contribution, whether it is suitable to compare SL-RSRP and SD-RSRP measurement to be used of triggering a measurement report is discussed and analyzed from RAN1’s perspective. The corresponding proposed reply on the LS can be as follows:

***Proposal 1: From RAN1’s perspective, it is not supported for the comparison of SL-RSRP and SD-RSRP measurement be used for the purposes of triggering a measurement report.***

### [R1-2302778](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302778.zip) Intel Corporation

In this contribution, we derived the following observations and proposals:

**Observation 1:**

* **The *event Z2* discussed in RAN2 may suffer from the following issues: i) the remote UE may not be able to compare the measurements from the two relay UEs given that the L2 IDs of remote UE and relay UE are different between the serving relay UE’s communication message (based on which SL-RSRP is measured) and discovery message (based on which SD-RSRP is measured); ii) a different power control mechanism may be applied on each PC5 unicast link, while gNB may not know if the reported value is SL-RSRP or SD-RSRP, and therefore there may not be able to effectively compensate for different power allocation.**

**Proposal 1:**

**Considering the issues highlighted in Observation 1, and without any further details, RAN1 considers comparison between SL-RSRP and SD-RSRP measurement as unfeasible**

### [R1-2302824](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302824.zip) InterDigital, Inc.

In this contribution, we have discussed and propose the following:

***Proposal 1****: Send a response LS with following answers (also draft response LS in the appendix):*

***Q1:*** *Can the comparison of SL-RSRP and SD-RSRP measurement be used for the purposes of triggering a measurement report?*

***Response:*** *From RAN1 perspective:*

* *if the target relay UE is in RRC\_CONNECTED, comparison is possible for the purposes of triggering a measurement report as the network can determine an appropriate offset in the trigger from knowledge of the Uu path loss of the source and target relay UEs and the SL path loss between source and remote UE.*
* *if the target relay UE is in RRC\_IDLE/RRC\_INACTIVE, comparison can be performed within an error range that is known to the network because the network can configure the range of possible Uu path loss of the target relay UE for transmission of the discovery.*

***Q2:*** *Can the comparison of SL-RSRP measurements from different UEs be used for the purposes of triggering a measurement report?*

***Response:*** *From RAN1 perspective because the same quantities are being compared for both relays, direct comparison for the purposes of triggering a measurement report is possible.*

### [R1-2302921](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302921.zip) LG Electronics

In this contribution, we discussed how RAN1 provides feedbacks on RAN2’s question in LS [1]. The following observation and proposal are given.

***Observation: The measurement event using the direct comparison of SL-RSRP and SD-RSRP measurements could trigger the unnecessary reporting due to the SL pathloss-based power control. Furthermore, even the offset value semi-statically configured by the network is difficult to effectively solve this issue.***

***Proposal: RAN1 provides an answer to the question on RAN2 LS [1] as follows:***

* ***From the perspective of RAN1, for the indirect-to-indirect path switch procedure, there is no strong technical motivation to newly define the measurement reporting event using the comparison of SL-RSRP and SD-RSRP measurements other than the Event Z1.***

### [R1-2303322](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303322.zip) Ericsson

Based on the discussion in the previous sections we propose the following:

Proposal 1 It is not straightforward to establish one-to-one mapping between SL-RSRP and SD-RSRP given that there exist power control and beamforming, etc., on the UE-to-UE link.

### [R1-2303371](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303371.zip) MediaTek Inc.

Based on the discussion and analysis above, following proposal is given.

**Proposal 1: For the comparison of SL-RSRP and SD-RSRP measurement, reply RAN2 as follows:**

It should be clarified by RAN2 at first the criterion on the comparison between SL-RSRP and SD-RSRP.

### [R1-2303465](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303465.zip) Apple

In this contribution, we provided our views on comparison of SL-RSRP and SD-RSRP measurements. Our observations and proposal are as follows:

***Observation 1:*** *The PSSCH transmit power for sidelink broadcast and sidelink unicast is subjective to Uu link pathloss, while the PSSCH transmit power for sidelink unicast may be additionally subjective to sidelink pathloss.*

***Observation 2:*** *A UE’s Uu link pathloss is independent of this UE’s sidelink pathloss to pair UE.*

***Observation 3:*** *Even if the measured SD-RSRP of candidate relay UE is an offset better than the measured SL-RSRP of serving relay UE, the potential measured SL-RSRP of candidate relay UE is likely worse than the measured SL-RSRP of serving relay UE.*

***Proposal 1:*** *The comparison of SL-RSRP measurements and SD-RSRP measurements is not used for the purpose of triggering a measurement report at higher layer.*

### [R1-2303857](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303857.zip) Huawei, HiSilicon

SL-RSRP and SD-RSRP may differ given the different transmission power for PSSCH carrying communication and discovery messages, due to possible different , , and subject to or not. If RAN2 can address such difference, it’s possible that the comparison of SL-RSRP and SD-RSRP measurement can be used for the purposes of triggering a measurement report.

***Proposal 1: Reply to RAN2 as follows:***

* *The comparison of SL-RSRP and SD-RSRP measurement can be used for the purposes of triggering a measurement report, if RAN2 can address the difference between transmission power for PSSCH carrying communication and discovery messages due to different priority,* , *, and subject to or not.*

### [R1-2303873](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303873.zip) Nokia, Nokia Shanghai Bell

In this contribution we discussed the question raised in RAN2’s LS on Comparison of SL-RSRP and SD-RSRP measurements and made the following observations and proposals:

**Observation 1: Unicast is subject to transmit power control based on SL pathloss (if configured), broadcast is not.**

**Observation 2: For CBR-based power control (if configured), transmit power may depend on priority. Priority may be different for discovery messages and the transmissions over which SL-RSRP is measured.**

**Observation 3: A direct comparison of SL-RSRP and SD-RSRP is not meaningful.**

**Proposal 1: Respond to RAN2 that a direct comparison of SL-RSRP and SD-RSRP is not meaningful.**

# References

1. [R1-2302280](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302280.zip)([R2-2302234](http://www.3gpp.org/ftp//TSG_RAN/WG2_RL2/TSGR2_121/Docs/R2-2302234.zip)) LS on Comparison of SL-RSRP and SD-RSRP measurements RAN2