**3GPP TSG RAN WG1 Meeting #109-e R1-22xxxxx**

**e-Meeting, May 9th- 20th, 2022**

**Agenda Item: 7.1**

**Source: Moderator (Huawei)**

**Title: draft Summary of email discussion [109-e-NR-CRs-02] PL-RS configuration of SCells**

**Document for: Discussion and Decision**

# Introduction

Two issues are discussed in this documents.

An issue is identified in [1][2][3] that

**Issue#1**:

* A UE is not required to obtain MIB of SCell. However, to determine PUSCH/PUCCH/SRS transmission power, in current TS 38.213, the RS resource for PL calculation is derived from a SS/PBCH block which is linked to obtaining MIB of the serving cell if the *pathlossReferenceRS* is not configured. Therefore, a clarification for this case is needed. For example,

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| **7.1.1 for PUSCH (TS38.213 v15.14.0):**  - is a downlink pathloss estimate in dB calculated by the UE using reference signal (RS) index  for the active DL BWP, as described in Clause 12, of carrier  of serving cell  - If the UE is not provided *PUSCH-PathlossReferenceRS* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource from the SS/PBCH block that the UE uses to obtain *MIB*  [Notes: Similar texts can be found in 7.2.1 and 7.3.1 for PUCCH and SRS, respectively.] |

Another issue is raised in [3] that,

**Issue#2**:

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| 38.213 defines in the beginning of clause 7 that   |  | | --- | | A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in Clauses 7.1.1, 7.2.1, and 7.3.1. |   It appears that the lack of definition for what “maintain” in this context means and when a patloss estimate can be considered as being maintained has been a cause of some debate in RAN4. This discussion has relevance in making sure that the SCell activation delay is not unnecessarily prolonged when e.g. one can assume that a PL estimate is not maintained for a deactivated SCell and additional delays might arise from PL estimation when an SCell with UL configuration is being activated. From RAN1 perspective it should be clear that as long as at most 4 pathloss estimates have been configured to the UE, any of the configured pathloss estimates that is relevant for a particular UL transmission at the time of transmitting it is considered maintained if at least one of the pathloss estimate RS has been transmitted after the UE has applied the new configuration.  **Proposal 2: Clarify that as long as the maximum number of path loss estimates is not exceeded, a pathloss estimate relevant for an uplink transmission can always be considered as maintained at the time the UL transmission takes place.**  **Proposal 3: Indicate to RAN4 that for an SCell with UL configuration, the pathloss estimate is obtained during the cell synchronization procedure and it does not add to the SCell activation delay.** |

As per chair’s guidance, these issues are discussed and the discussion is expected to complete by May 13.

[109-e-NR-CRs-02] PL-RS configuration of SCells by May 13 – Frank (Huawei)

* Relevant tdocs: [R1-2203112](file:///D:\Documents\3GPP%20documents\RAN1\TSGR1_109-e\Docs\R1-2203112.zip), [R1-2203113](file:///D:\Documents\3GPP%20documents\RAN1\TSGR1_109-e\Docs\R1-2203113.zip) and also consider [R1-2204821](file:///D:\Documents\3GPP%20documents\RAN1\TSGR1_109-e\Docs\R1-2204821.zip) under agenda item 5.

# Phase I of Discussions

## Issue#1: The RS resource for SCell pathloss calculation

### Q1: Regarding the UE behavior for determination of RS resource for Scell pathloss calculation if RRC parameter *pathlossreference* is not configured for the SCell, which alternative below is correct?

**Alt 1-1:** There is no difference between PCell and SCell, i.e. “the UE calculates pathloss  using a RS resource from the SS/PBCH block that the UE uses to obtain MIB” as in current TS 38.213. As a result, **the UE is required to obtain MIB for SCell in this case**.

**Alt 1-2:** It is different between PCell and SCell where in SCell the UE is **NOT** required to obtain MIB and can take one SS/PBCH block that is **NOT** linked to any MIB acquisition for pathloss calculation.

Companies’ views are welcome.

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| *Company* | *View* |
| Apple | The whole discussion is unnecessary and redundant, since RAN4 already agreed to use beam indication RS configured in PUCCH-spatialRelationInfo. |
| vivo | We believe that not configuring pathlossReferenceRSs but configuring SpatialRelationInfo is a corner case, if allowed. We prefer to make a conclusion that pathlossReferenceRSs are expected to be configured for SCell, so that no additional UE behavior needs to be defined. |
| Nokia, NSB | **Alt1-1** in the sense that there is no difference between PCell and SCell. The PCell PL-RS reference is not really having anything to do with MIB-reading, MIB reading is just a convenient way to point to the SSB the UE is synched to  **Alt1-2** in the sense that the UE is not required to obtain MIB |
| CATT | This does not need to be discussed. RAN4’s conclusion is consistent with what we discussed and agreed in Rel-15 Power control session. |
| Samsung | We slightly prefer Alt 1-2. UE calculates SCell pathloss from ‘associated’ SSB, but it should not mean UE always acquires MIB for SCell. |
| ZTE | We think the discussion is not needed since RAN4 has made the conclusion as pointed out by the other companies. |
| QC | Put aside RAN4’s conclusion, we believe Alt 1-2 is more accurate. |
| Huawei, HiSilicon | Alt 1-2 |
| Moderator | **Summary:**   * Three companies referred to a RAN4 WA that has a different PL-RS from any SSB that the UE uses to obtain MIB. Therefore, their views are categorized into Alt 1-2. * Four companies clearly prefer Alt 1-2. * One company prefers a change for SCell case where RRC pathlossReferenceRS is always configured for SCell, which the concerned RAN1 text is not applied to SCell but only PCell. Therefore, its view seems Alt 1-2 as well. * No company prefer Alt 1-1.   A consensus seems to be   * **Alt 1-2 is the only option.**   @Apple, CATT, ZTE  The discussion here is about RAN1 spec maintenance to avoid any UE requirement to obtain MIB on SCell. It is obviously not subject to the RAN4 WA because it is only RAN1 who can confirm the WA, as copied below.   |  | | --- | | **R1-2200896(R4-2202602)**  **….**  **To: RAN1**  **ACTION:** RAN4 respectfully asks RAN1 to confirm RAN4 working assumption and answer the corresponding questions if needed. |   @CATT, the RAN4 WA is obviously not line with the current RAN1 spec. Regarding your comment “agreed in Rel-15 Power control session”, we don’t see any RAN1 agreement for it. If any, please kindly share it.  @vivo, the case associated with the concerned text and concerned UE behavior is independent of *SpatialRelationInfo* configuration. It is just no configured *pathlossReferenceRS*, which seems not corner case. However, your view seems to say that **the RAN4 WA only address a corner case** where *SpatialRelationInfo* happens to be configured when *pathlossReferenceRS* is not configured. |

### Q2: Assuming Alt 1-2 for Q1, which alternative below is correct for the changes of a CR?

**Alt 2-1:** The RS resource used for SCell pathloss calculation is associated with SCell activation, which seems in line with the spirit of RAN1#92 agreement below. As examples, two CRs to reflect this can be found in [2] and [3], as copied below.

**Alt 2-2:** The RS resource used for SCell pathloss calculation is **NOT** associated with SCell activation nor with any time and frequency synchronization for the SCell. If any company prefers this, please provide your solution and its changes in details.

If Alt 1-1 is correct for Q1, then a CR is necessary to clarify the concerned UE behavior. If Alt 1-2 is correct for Q1, then no CR is needed and a conclusion seems sufficient. Here, Alt 1-1 is assumed, what exact spec changes to capture it are discussed.

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| The concerned specification text is sourced from the following RAN1#92 agreement.  *Agreement:*  *At least for the case of initial access*   * *UE will use the SSB identified during the initial access as the DL RS/SSB for pathloss estimation for PUSCH (including MSG3) before DL RS(s) is explicitly configured for pathloss measurement.* * *UE will use the SSB identified during the initial access as the DL RS/SSB for pathloss estimation for PUCCH before DL RS(s) is explicitly configured for pathloss measurement.* |

In [2], a CR for Alt 2-1 (for PUSCH, PUCCH and SRS, respectively) is,

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| 7.1.1 UE behavior *====Unchanged parts====*  - is a downlink pathloss estimate in dB calculated by the UE using reference signal (RS) index  for the active DL BWP, as described in Clause 12, of carrier  of serving cell  - If the UE is not provided *PUSCH-PathlossReferenceRS* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource from the SS/PBCH block that the UE uses to obtain *MIB* when the serving cell is PCell or PSCell and using a RS resource obtained from an SS/PBCH block that the UE uses for SCell activation when the serving cell is SCell  *====Unchanged parts====* 7.2.1 UE behaviour *====Unchanged parts====*  - is a downlink pathloss estimate in dB calculated by the UE using RS resource index  as described in Clause 7.1.1 for the active DL BWP  of carrier  of the primary cell  as described in Clause 12  - If the UE is not provided *pathlossReferenceRSs* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from the SS/PBCH block that the UE uses to obtain *MIB* when the serving cell is PCell or PSCell and using a RS resource obtained from an SS/PBCH block that the UE uses for SCell activation when the serving cell is SCell  *====Unchanged parts====* 7.3.1 UE behaviour *====Unchanged parts====*  -  is a downlink pathloss estimate in dB calculated by the UE using RS resource index  as described in Clause 7.1.1 for the active DL BWP of serving cell  and SRS resource set  [6, TS 38.214]. The RS resource index  is provided by *pathlossReferenceRS* associated with the SRS resource set  and is either a *ssb-Index* providing a SS/PBCH block index or a *csi-RS-Index* providing a CSI-RS resource index  - If the UE is not provided *pathlossReferenceRS* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from the SS/PBCH block that the UE uses to obtain *MIB* when the serving cell is PCell or PSCell and using a RS resource obtained from an SS/PBCH block that the UE uses for SCell activation when the serving cell is SCell  - If the UE is provided *pathlossReferenceLinking*, the RS resource is on a serving cell indicated by a value of *pathlossReferenceLinking*  *====Unchanged parts====* |

In [3], a CR for Alt 2-1 is,

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| --- |
| **7.1.1 for PUSCH:**  - is a downlink pathloss estimate in dB calculated by the UE using reference signal (RS) index for the active DL BWP, as described in clause 12, of carrier of serving cell  - If the UE is not provided *PUSCH-PathlossReferenceRS* and *enableDefaultBeamPL-ForSRS*,or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource from an SS/PBCH block with same SS/PBCH block index as the one the UE uses to obtain *MIB*, or for a secondary cell where the UE does not obtain a *MIB*, using the SS/PBCH block the UE acquired the time and frequency synchronization for that cell.  **7.2.1 for PUCCH:**  - is a downlink pathloss estimate in dB calculated by the UE using RS resource index  as described in clause 7.1.1 for the active DL BWP  of carrier  of the primary cell  as described in clause 12  - If the UE is not provided *pathlossReferenceRSs* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from an SS/PBCH block with same SS/PBCH block index as the one the UE uses to obtain *MIB*, or for a secondary cell where the UE does not obtain a *MIB*, using the SS/PBCH block the UE acquired the time and frequency synchronization for that cell. |

Companies’ views are welcome.

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| *Company* | *View* |
| Apple | Do not support any CR above |
| vivo | We don’t see the needs to change current spec. |
| Nokia, NSB | Alt 2-1. To us the two CRs are equivalent and we’d be OK with either of the two |
| CATT | We don’t support the CR. |
| Samsung | For the clarification, we might need TP when Alt 1-2 is selected, not Alt 1-1. Among two TPs above, we slightly prefer later one which captures Scell UE operation only. |
| ZTE | We don’t see the need of this CR. |
| QC | If RAN4’s conclusion is deemed not sufficient, we are OK with either of the above TP. |
| Huawei, HiSilicon | Alt 2-1. |
| Moderator | **Summary**:   * Four companies don’t support any of the CRs. * Three companies are fine with either of the CRs. * One company slightly prefer the later CR.   In Q1, no company selected Alt 1-1 and Alt 1-2 seems the only option.  Therefore, a CR is needed to clarify the RAN1 spec.  Because all of the four companies referred to the RAN4 WA in Q1, their solution/CR seems to always force the gNB to configure *SpatialRelationInfo* when *pathlossReferenceRS* is not configured. |

### Q3: If Alt 2-1 for Q2 is to be captured in specification, which alternative CR below is preferred?

**Alt 3-1:** The CR in [2]. Any revisions are welcome.

**Alt 3-2:** The CR in [3]. Any revisions are welcome.

Companies’ views are welcome.

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| --- | --- |
| *Company* | *View* |
| Apple | No CR is needed |
| vivo | Neither is supported. |
| Nokia, NSB | We are OK with either one. |
| CATT | No CR is needed. |
| Samsung | Alt 3-2 as mentioned above |
| ZTE | No CR is needed. |
| Huawei, HiSilicon | Alt 3-1. If Alt 3-2 includes SRS as well, we are also fine with it. |

### Q4: From which release is such change in Q3 applied?

**Alt 4-1:** from Rel-15

**Alt 4-2:** from Rel-16

**Alt 4-3:** fromother release

During the preparation phase, one company suggested that the CR was applied since Rel-16 rather than Rel-15.

Companies’ views are welcome.

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| *Company* | *View* |
| Apple | No CR is needed |
| vivo | None of them are supported. |
| Nokia, NSB | Technically this is a Rel-15 issue, but we’d be OK with any release, but initially thought that this issue is perhaps best addressed under the Rel-17 WI that allows for deactivating the SCG. |
| CATT | No CR is needed. |
| ZTE | No CR is needed. |
| QC | If the group decides to have a TP, we don’t support it for Rel-15. We can accept it for Rel-17. |

## Issue#2: The association between SCell activation delay and the limited number of pathloss estimation for a UE.

### Q1: Whether the Proposal 2 in [3] is agreeable?

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| **Proposal 2: Clarify that as long as the maximum number of path loss estimates is not exceeded, a pathloss estimate relevant for an uplink transmission can always be considered as maintained at the time the UL transmission takes place.** |

Companies’ views are welcome.

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| --- | --- |
| *Company* | *View* |
| Apple | We do not know why this needs to be discussed. |
| vivo | We do not see the needs to discuss this issue, since how to maintain or estimate path loss is the UE implementation behavior. |
| Nokia, NSB | The issue is that RAN1 just says a path loss estimate is maintained, and now RAN4 is debating what “maintained” means, and when is a PL estimate considered as maintained. This underlines the need for this discussion when even other WGs in the same TSG debate the meaning of the specification. |
| CATT | This does not need to discuss again. |
| Samsung | We do not think current spec requires UE to always track PL-RS on inactive SCell. But in our point of view, it’s no critical issue. The uncertainty in spec dose not bring a critical issue. Hence, we have a small concern on Proposal 2. |
| ZTE | Share the same views with the other companies that the discussion is not needed. |
| QC | No need of further discussion |

### Q2: Whether the Proposal 3 in [3] is agreeable?

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| **Proposal 3: Indicate to RAN4 that for an SCell with UL configuration, the pathloss estimate is obtained during the cell synchronization procedure and it does not add to the SCell activation delay.** |

Companies’ views are welcome.

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| --- | --- |
| *Company* | *View* |
| Apple | No |
| vivo | We do not see the needs to discuss this issue. |
| Nokia, NSB | This is of course related to Q1 of issue#, and if nothing can be agreed, then LS is not needed. And conversely if we can agree to something, communicating this to RAN4 would be helpful. |
| CATT | No |
| Samsung | Similar view as the above for Q1. |
| ZTE | No. |
| QC | Agree with Nokia. |

## Other Issues

Issues or comments that do not fit in any of the previous sections of this document can be provided here.

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| *Company* | *View* |
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# Phase II of Discussions

## Issue#1: The RS resource for SCell pathloss calculation

### Q1: Regarding the UE behavior for determination of RS resource for Scell pathloss calculation if RRC parameter *pathlossreference* is not configured for the SCell, which alternative below is correct?

**Alt 1-1:** There is no difference between PCell and SCell, i.e. “the UE calculates pathloss  using a RS resource from the SS/PBCH block that the UE uses to obtain MIB” as in current TS 38.213. As a result, **the UE is required to obtain MIB for SCell in this case**.

**Alt 1-2:** It is different between PCell and SCell where in SCell the UE is **NOT** required to obtain MIB and can take one SS/PBCH block that is **NOT** linked to any MIB acquisition for pathloss calculation.

**Summary:**

* Three companies referred to a RAN4 WA that has a different PL-RS from any SSB that the UE uses to obtain MIB. Therefore, their views are categorized into Alt 1-2.
* Four companies clearly prefer Alt 1-2.
* One company prefers a change for SCell case where RRC pathlossReferenceRS is always configured for SCell, which the concerned RAN1 text is not applied to SCell but only PCell. Therefore, its view seems Alt 1-2 as well.
* No company prefer Alt 1-1.

A consensus seems to be

* **Alt 1-2 is the only option.**

@Apple, CATT, ZTE

The discussion here is about RAN1 spec maintenance to avoid any UE requirement to obtain MIB on SCell. It is obviously not subject to the RAN4 WA because it is only RAN1 who can confirm the WA, as copied below.

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| --- |
| **R1-2200896(R4-2202602)**  **….**  **To: RAN1**  **ACTION:** RAN4 respectfully asks RAN1 to confirm RAN4 working assumption and answer the corresponding questions if needed. |

@CATT, the RAN4 WA is obviously not line with the current RAN1 spec. Regarding your comment “agreed in Rel-15 Power control session”, we don’t see any RAN1 agreement for it. If any, please kindly share it.

@vivo, the case associated with the concerned text and concerned UE behavior is independent of *SpatialRelationInfo* configuration. It is just no configured *pathlossReferenceRS*, which seems not corner case. However, your view seems to say that **the RAN4 WA only address a corner case** where *SpatialRelationInfo* happens to be configured when *pathlossReferenceRS* is not configured.

***FL proposal 1****:* *As a conclusion, if RRC parameter pathlossreference is not configured for the SCell, confirm that the UE behavior for determination of RS resource for Scell pathloss calculation is different between PCell and SCell where the UE is* ***NOT*** *required to obtain MIB in SCell and can take one SS/PBCH block that is* ***NOT*** *linked to any MIB acquisition for pathloss calculation.*

* *FFS: the exact SS/PBCH block for pathloss calculation of SCell*

Companies’ views are welcome.

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| *Company* | *View* |
| Apple | Do not support. RAN4 has already declared their WI as completed. RAN4’s conclusion is the only solution. |
| Samsung | As a conclusion, we don’t need to clarify whether the UE obtain MIB in SCell or not. It is sufficient to clarify the UE determines RS resource for Scell pathloss calculation with SS/PBCH used for SCell activation. So, we would like to suggest as follow:  ***FL proposal 1****:* *As a conclusion, if RRC parameter pathlossreference is not configured for the SCell, confirm that the UE calculates pathloss of SCell using a RS resource obtained from the SS/PBCH block used for SCell activation. ~~confirm that the UE behavior for determination of RS resource for Scell pathloss calculation is different between PCell and SCell where the UE is~~* ***~~NOT~~*** *~~required to obtain MIB in SCell and can take one SS/PBCH block that is~~* ***~~NOT~~*** *~~linked to any MIB acquisition for pathloss calculation.~~* |
| ZTE | We don’t support since generally the network may configure the PL-RS for the Scell. We don’t see a need to do any optimization in this stage. |
| Nokia, NSB | We’d be OK with the FL proposal, as well as the Samsung modification. It is worth noting that there is no specification for the PCell SSB selection for MIB reading, it just makes sense that the SSB it syncs to is the one it uses to read MIB too, and that’s also then the PL-RS reference. |
| vivo | Based on companies’ views, we still fail to see NW dose not configure PL-RS for SCell is a common case. It seems the above proposed conclusion is incomplete, since which SS/PBCH block is still unclear. We are not fine with above proposal until there is a clear solution. |
| CATT | We don’t support it. When SCell is added by RRC reconfiguration, the ServingCellConfig will include PUSCH-PowerControl IE, which includes PathLossReferenceRS. If Pathloss reference RS is not included, SSB used for SCell activation should be used as RS for PL calculation. |

### Q2: Assuming Alt 1-2 for Q1, which alternative below is correct for the changes of a CR?

**Alt 2-1:** The RS resource used for SCell pathloss calculation is associated with SCell activation, which seems in line with the spirit of RAN1#92 agreement below. As examples, two CRs to reflect this can be found in [2] and [3], as copied below.

**Alt 2-2:** The RS resource used for SCell pathloss calculation is **NOT** associated with SCell activation nor with any time and frequency synchronization for the SCell. If any company prefers this, please provide your solution and its changes in details.

**Summary**:

* Four companies don’t support any of the CRs.
* Three companies are fine with either of the CRs.
* One company slightly prefer the later CR.

In Q1, no company selected Alt 1-1 and Alt 1-2 seems the only option.

**Therefore, a CR is needed to clarify the RAN1 spec.**

Because all of the four companies above referred to the RAN4 WA in Q1, their solution/CR seems to always force the gNB to configure *SpatialRelationInfo* when *pathlossReferenceRS* is not configured. In moderator’s understanding, this solution with configuration restriction is not acceptable to network vendors unless sufficient network vendors to support it.

Alt 2-1 seems the best option. But if Alt 2-1 is not agreeable, at least Alt 1-2 can be reflected, then whether the following is agreeable?

***FL proposal 2****:*

* A RAN1 CR to replace “If the UE is not provided *PUSCH-PathlossReferenceRS*” in TS 38.213 with “If the serving cell is a primary cell and the UE is not provided *PUSCH-PathlossReferenceRS*”. Similar changes to the subclause of PUCCH and SRS power control.

Companies’ views are welcome.

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| *Company* | *View* |
| Apple | Do not support |
| Samsung | We don’t think it’s needed. The previous TPs are enough. |
| ZTE | We don’t support. |
| Nokia, NSB | We also think the previous TPs are enough. |
| Vivo | It is not necessary to discuss this proposal until the previous one is clearly discussed. |
| CATT | We don’t see the need of the TP. |

## Issue#2: The association between SCell activation delay and the limited number of pathloss estimation for a UE.

### Q1: Whether the Proposal 2 in [3] is agreeable?

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| **Proposal 2: Clarify that as long as the maximum number of path loss estimates is not exceeded, a pathloss estimate relevant for an uplink transmission can always be considered as maintained at the time the UL transmission takes place.** |

**Summary**:

5 companies don’t want further discussion.

1 company showed small concern.

No new proposal can be provided. But if any further reply from proponent, it can be provided below.

Companies’ views are welcome.

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| *Company* | *View* |
| Nokia, NSB | We acknowledge that other companies have not seen this issue and don’t pursue the proposal further. |
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### Q2: Whether the Proposal 3 in [3] is agreeable?

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| **Proposal 3: Indicate to RAN4 that for an SCell with UL configuration, the pathloss estimate is obtained during the cell synchronization procedure and it does not add to the SCell activation delay.** |

**Summary**:

4 companies don’t want further discussion.

1 company showed small concern.

No new proposal can be provided. But if any further reply from proponent, it can be provided below.

Companies’ views are welcome.

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| *Company* | *View* |
| Nokia, NSB | This proposal is obsoleted when the previous proposal is dropped. This thread can be closed. |
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## [TBD] Draft CR for TS 38.213

TBD

## [TBD] A LS to other WGs, if any

TBD

# Conclusions

TBD

# References

1. R1-2203112 Discussion on PL-RS configuration of SCells, Huawei, HiSilicon
2. R1-2203113 Corrections on PL-RS configuration, Huawei, HiSilicon
3. R1-2204821 On the PL-RS configuration of PUCCH SCell to be activated, Nokia, Nokia Shanghai Bell

# Appendix: