**3GPP TSG-RAN WG4 Meeting # 102-e R4-22XXXXX**

**Electronic Meeting, February 21 – March 3, 2022**

**Agenda item:** 10.22

**Source:** Moderator (Huawei, HiSilicon)

**Title:** Email discussion summary for [102-e][232] LTE\_NR\_DC\_enh2

**Document for:** Information

# Introduction

This email thread discusses the WI on Further Multi-RAT Dual-Connectivity enhancements was approved in [RP-201040]. The objectives of the WI are duplicated as below,

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| 1. Support efficient activation/de-activation mechanism for one SCG and SCells
* Support for one SCG applies to (NG)EN-DC, and NR-DC [RAN2, RAN3, RAN4]
* Support for SCells applies to NR CA, based on RAN1 leading mechanisms [RAN1, RAN2, RAN4]
* This objective applies to FR1 and FR2
1. Support of conditional PSCell change/addition [RAN2,RAN3, RAN4]
* support scenarios which are not addressed in Rel-16 NR mobility WI
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Three sub-topics are discussed:

-Sub-topic 1: Efficient activation/de-activation mechanism for SCells (i.e., temporary RS for efficient SCell activation)

-Sub-topic 2: Efficient activation/de-activation mechanism for one SCG

-Sub-topic 3: Conditional PSCell change and addition

List of candidate target of email discussion for 1st round and 2nd round:

* 1st round: Invite companies to comment in each sub-topic.
* 2nd round: TBA

# Topic #1: Efficient activation/de-activation mechanism for SCells (i.e., temporary RS for efficient SCell activation)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2203744](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203744.zip) | Apple | Proposal 1: (option 1)* Tuncertainty\_MAC for scenario #3: SCell to be activated belongs to FR2, if there is no active serving cell on that FR2 band, and target SCell is known to UE.
	+ Assuming PDCCH TCI and PDSCH TCI (when applicable) shall be associated with the triggered temporary RS burst:

if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max (Ttemp\_RS+ 2ms, Tuncertainty\_SP)if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max (Ttemp\_RS + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)under the condition that One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,The TCI state for PDCCH/PDSCH that is the same as A-TRS is assumed during SCell activation until changed by network after SCell activation. |
| [R4-2203858](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203858.zip) | Qualcomm Incorporated | **Proposal 1**: For FR2 SCell activation, if there is no active serving cell on that FR2 band, and target SCell is known to UE, the activation delay is defined as below:* Assuming PDCCH TCI and PDSCH TCI (when applicable) shall be associated with the triggered temporary RS burst:
	+ if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max (Ttemp\_RS+ 2ms, Tuncertainty\_SP)
	+ if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max (Ttemp\_RS + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)

under the condition that * + One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,
	+ The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,
	+ The TCI state for PDCCH/PDSCH that is the same as A-TRS is assumed during SCell activation until changed by network after SCell activation.

And the following statement from the legacy requirement is reproduced in the requirement:* + UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation command at the same time

**Proposal 2-A**: For the following cases, temporary A-TRS burst based multiple SCell activation enhancement is not supported:* Any of to-be-activated SCells triggered by one MAC-CE is unknown
	+ Exceptionally, if the target FR2 SCell is unknown and if on the same band UE also has at least one parallel to-be-activated known SCell, the enhancement is supported
* More than two SSB bursts are expected to be received/processed for the activation
* There can be more cases to which Option 1 based enhancement is not applicable depending on RAN1 decision

**Proposal 2-B**: Temporary A-TRS based SCell activation enhancement is applicable when more than one SCell is concurrently activated for the following cases from the legacy multiple SCell activation requirements:* The cases where the requirements are TFirstSSB\_MAX\_multiple\_scells + Trs + 5ms or TFirstSSB\_MAX\_multiple\_scells + 5ms when the SCell is known and belong to FR1 and the SCell measurement cycle is equal to or smaller than 160ms.
* The cases where the requirement is TFirstSSB\_MAX\_multiple\_scells + Trs + 5ms when the SCell is known and belongs to FR1 and the SCell measurement cycle is larger than 160ms.
* The cases where the requirement is TFirstSSB\_MAX\_multiple\_scells + TSMTC\_MAX\_multiple\_scells+Trs +5ms when the SCell is unknown and belongs to FR1.
* The case where the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting.
* The case where the target SCell is known to UE and periodic CSI-RS is used for CSI reporting.
* The case where the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting.
* The case where the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting.
* For the above cases, the SCell to be concurrently activated based on temporary A-TRS on one of the to-be-activated SCells shall be in the same band as the SCell where the temporary A-TRS is received.
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| [R4-2204206](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204206.zip) | MediaTek (Shenzhen) Inc. | Proposal 1: If there is no active serving cell on that FR2 band, and target SCell is known to UE * + if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max (Ttemp\_RS+ 2ms, Tuncertainty\_SP)
	+ if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max (Ttemp\_RS + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)

under the condition that * + One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,
	+ The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,
	+ The TCI state for PDCCH/PDSCH that is the same as A-TRS is assumed during SCell activation until changed by network after SCell activation.
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| [R4-2204287](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204287.zip) | OPPO | Observation 1: (T\_uncertainty\_MAC + T\_FineTiming) can be replaced by with T\_ATRS.Proposal 1: Assuming PDCCH TCI and PDSCH TCI (when applicable) shall be associated with the triggered temporary RS burst:if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max (Ttemp\_RS+ 2ms, Tuncertainty\_SP)if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max (Ttemp\_RS + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)under the condition that One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,The TCI state for PDCCH/PDSCH that is the same as A-TRS is assumed during SCell activation until changed by network after SCell activation. |
| [R4-2204476](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204476.zip) | Ericsson | **Proposal 1:** SCell activation delay requirements for activation of known SCell in FR2 band without active serving cell shall account for potential uncertainty pertaining to TCI state activation. The following timelines are proposed:- Tactivation\_time = 3ms + max(TATRS + 2ms, Tuncertainty\_MAC + 2ms, Tuncertainty\_SP) when semi-persistent CSI-RS are used for CSI measurements;- Tactivation\_time = max(TATRS + 5ms, Tuncertainty\_MAC + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ);where TATRS is time period between reception of SCell activation command and the full TRS burst. |
| [R4-2204896](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204896.zip) | Huawei, Hisilicon | Proposal 1: If there is no active serving cell on that FR2 band, and target SCell is known to UE, * if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max(Ttemp\_RS+ 2ms, Tuncertainty\_MAC, Tuncertainty\_SP)
* if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max(Ttemp\_RS + 5ms, Tuncertainty\_MAC+3ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)
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| [R4-2205646](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205646.zip) | Nokia, Nokia Shanghai Bell | 1. Support at least option 1 for Tuncertainty\_MAC for scenario 3.
	* Option 1: Assuming PDCCH TCI and PDSCH TCI (when applicable) shall be associated with the triggered temporary RS burst:

if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max (Ttemp\_RS+ 2ms, Tuncertainty\_SP)if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max (Ttemp\_RS + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)under the condition that One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,The TCI state for PDCCH/PDSCH that is the same as A-TRS is assumed during SCell activation until changed by network after SCell activation. |

## Open issues summary

### Sub-topic 1-1: Temporary RS based SCell activation delay

**Issue 1-1:****Tuncertainty\_MAC for scenario #3**

**Scenario #3: SCell to be activated belongs to FR2, if there is no active serving cell on that FR2 band, and target SCell is known to UE.**

* Proposals
	+ Option 1(Apple, QC, MTK, OPPO, Nokia): Assuming PDCCH TCI and PDSCH TCI (when applicable) shall be associated with the triggered temporary RS burst:

if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max (Ttemp\_RS+ 2ms, Tuncertainty\_SP)

if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max (Ttemp\_RS + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)

under the condition that

One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,

The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,

The TCI state for PDCCH/PDSCH that is the same as A-TRS is assumed during SCell activation until changed by network after SCell activation.

* + Option 2 (Huawei, Ericsson): **Not** assuming PDCCH TCI and PDSCH TCI (when applicable) is associated with the triggered temporary RS burst.
		- Option 2a (Huawei):

if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max(Ttemp\_RS+ 2ms, Tuncertainty\_MAC, Tuncertainty\_SP)

if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max(Ttemp\_RS + 5ms, Tuncertainty\_MAC**+3ms,** Tuncertainty\_RRC + TRRC\_delay-THARQ)

* + - Option 2b (Ericsson):

if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max(TATRS + 2ms, Tuncertainty\_MAC + 2ms, Tuncertainty\_SP)

if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max(TATRS + 5ms, Tuncertainty\_MAC **+ 5ms**, Tuncertainty\_RRC + TRRC\_delay-THARQ)

* Recommended WF

Further discussion

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 1. And we also want to include the following statement from the legacy requirement at the end of Option 1.UE receives the SCell activation command and TCI state activation command at the same time |
| MTK | Option 1 and we are open to add the statement mentioned by QC.According to the definition of known SCell for FR2, the TCI state is selected based on one of the latest reported SSB indexes. To our understanding, in R15/R16 UE needs to wait for the TCI state indication because more than one SSBs with indexes may be reported and UE needs the indication from gNB. However, now gNB has already made a selection when triggering A-TRS and UE does not need another indication anymore. Regarding the point to leave more flexibility for network, we cannot understand why the suitable TCI state for PDCCH/PDSCH is different from TRS as the activation delay is quite short.

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| For the first SCell activation in FR2 bands, the SCell is known if it has been meeting the following conditions:- During the period equal to 4s for UE supporting power class 1/5 and 3s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):- the UE has sent a valid L3-RSRP measurement report with SSB index - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation- During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes. |

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### Sub-topic 1-2: Multiple SCell activation enhancement

**Background**

The following agreements are made in last meeting [R4-2202688].

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| **Issue 1-4: Applicability rule for multiple SCell activation enhancement*** Agreements

Finalize single SCell activation requirements first. If time is not allowed, don’t define requirements for temporary RS based Multiple SCell Activation. |

Company continues to provide analysis on multiple SCell activation based on temporary RS at this meeting. As this is the last meeting for completing the core part requirements and there is no draft CR provided on this, we shall follow the previous agreement and finalize the single SCell activation requirements at this meeting. Requirements for multiple SCells activation enhancement can be further discussed in maintenance stage. Please comment on the following issue:

**Issue 1-2-1: Requirements of multiple SCell activation enhancement**

* Proposals
	+ Option 1: Define requirements of multiple SCell activation enhancement during maintenance stage.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | If, in any case, multiple SCell activation requirements can be defined in Rel-17, Option 1 is okay with us. |
| Intel | This proposal is fine to us. |
| MTK | Fine with option 1. |

**Issue 1-2-2: The NOT applicable cases for temporary A-TRS burst based multiple SCell activation enhancement, if yes for issue 1-2-1**

* Proposals
	+ Option 1(QC): For the following cases, temporary A-TRS burst based multiple SCell activation enhancement is not supported:
		- Any of to-be-activated SCells triggered by one MAC-CE is unknown
			* Exceptionally, if the target FR2 SCell is unknown and if on the same band UE also has at least one parallel to-be-activated known SCell, the enhancement is supported
		- More than two SSB bursts are expected to be received/processed for the activation
		- There can be more cases to which Option 1 based enhancement is not applicable depending on RAN1 decision
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| MTK | We think option 1 can be used as a start point. Maybe we will recognize more cases that is not applicable in RAN4. Therefore, regarding the last bullet, we suggest not to limit to “depending on RAN1 decision” only. |
|  |  |

**Issue 1-2-3: the applicable cases for temporary A-TRS burst based multiple SCell activation enhancement**

* Proposals
	+ Option 1(QC)：Temporary A-TRS based SCell activation enhancement is applicable when more than one SCell is concurrently activated for the following cases from the legacy multiple SCell activation requirements:
		- The cases where the requirements are TFirstSSB\_MAX\_multiple\_scells + Trs + 5ms or TFirstSSB\_MAX\_multiple\_scells + 5ms when the SCell is known and belong to FR1 and the SCell measurement cycle is equal to or smaller than 160ms.
		- The cases where the requirement is TFirstSSB\_MAX\_multiple\_scells + Trs + 5ms when the SCell is known and belongs to FR1 and the SCell measurement cycle is larger than 160ms.
		- The cases where the requirement is TFirstSSB\_MAX\_multiple\_scells + TSMTC\_MAX\_multiple\_scells+Trs +5ms when the SCell is unknown and belongs to FR1.
		- The case where the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting.
		- The case where the target SCell is known to UE and periodic CSI-RS is used for CSI reporting.
		- The case where the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting.
		- The case where the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting.
		- For the above cases, the SCell to be concurrently activated based on temporary A-TRS on one of the to-be-activated SCells shall be in the same band as the SCell where the temporary A-TRS is received.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | The list above can be served as a baseline. |
| MTK | It seems the same issue as 1-2-2 but using different description. Same view as commented on 1-2-2. |

## CRs/TPs comments collection

*For close-to-finalize Wis and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing Wis, suggest to focus on open issues discussion on 1st round.*

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2204897 (Huawei) | Company A |
| Company B |
|   |
|  |
| R4-2204901 (Huawei) | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: Efficient activation/de-activation mechanism for one SCG

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2203745](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203745.zip) | Apple | Proposal 1: existing min value and range of measCycleSCell can be reused for measCyclePSCell.Proposal 2: if the PSCell is activated from deactivated state without any parameter change (including PSCell change), Tprocessing = [10ms]. Otherwise:* Tprocessing = 20ms NR PSCell is in FR1 in EN-DC.
* Tprocessing = 40 ms if NR PSCell is in FR2 in EN-DC or NR-DC

Proposal 3: time/frequency tracking time (T∆) in PSCell activation delay is needed.Proposal 4: RACH-less PSCell activation delay can be defined asTconfig\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆+ TIU + 2 mswhere TIU is the interruption uncertainty in acquiring the first PUSCH transmission occasion/[SR on PUCCH] when UE is configured with RACH-less SCG.Proposal 5: Existing requirements for interruption due to PSCell addition/release can be used as baseline, i.e., 1ms interruption length.Proposal 6: If RLM/BFD is not configured, the current interruption requirement during measurements on deactivated inter-band SCC applies. If RLM/BFD is configured, the current interruption requirement during Scell dormancy applies([1]%).Proposal 7: regarding Interruption requirement due to RLM and BFD on deactivated PSCell, The same principle as the interruption due to SCell dormancy is applied ([0.5]%).Proposal 8: Timing requirements including Te and Tq don’t need to be specified when PSCell is deactivated. |
| [R4-2203859](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203859.zip) | Qualcomm Incorporated | **Proposal 1-A**: For the deactivated SCG, L3 measurement requirements for both PSCell and SCells in SCG are based on deactivated SCell with the following exceptions:* For deactivated PSCell, T\_SMTC is replaced by measCyclePSCell
* For deactivated SCells, measCycleSCell is replaced by max(measCyclePSCell, measCycleSCell)
* The minimum value of measCyclePSCell shall not be smaller than the minimum value of measCycleSCell, and preferably 320ms as the minimum value
* A configured DRX for SCG alone is not used in defining UE measurement requirements when the SCG is deactivated. Instead, a greater number between the configured DRX for SCG and a fixed number, e.g. 320ms, replaces it for measurement relaxation while the SCG is deactivated

**Proposal 1-B**: For RLM and BFD requirements for deactivated PSCell, a greater number between the configured DRX for SCG and a fixed number, e.g. 320ms, is used for measurement period determination while the cell is deactivated. And measCyclePSCell replaces T\_SSB.**Proposal 2**: UE processing time (Tprocessing) in PSCell activation delay is as below:* Tprocessing = 10ms NR PSCell is in FR1 in EN-DC
* Tprocessing = 20 ms if NR PSCell is in FR2 in EN-DC or NR-DC
* If any PSCell parameter is modified, Tprocessing shall not be less than 20ms.

**Proposal 3**: Time/frequency tracking time (T∆) in PSCell activation delay is needed.**Proposal 4**: A requirement for SCG activation with multiple cells shall be defined in Rel-17 timeframe |
| [R4-2204207](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204207.zip) | MediaTek (Shenzhen) Inc. | Proposal 1: Use the same minimum value and range of measCycleSCell for the parameter measCyclePSCell.Proposal 2: Measurement requirements for deactivated SCG can be specified as deactivated SCell by replacing measCycleSCell with measCyclePSCell.Proposal 3: For the case that PSCell change and PSCell activation command happen simultaneously, the existing PSCell change delay requirement applies.Proposal 4: For RACH based PSCell activation from deactivated state, Tprocessing is 20ms.Proposal 5: For RACH based PSCell activation from deactivated state, T∆ remains 1\*Trs ms.Proposal 6: Regarding whether BFD configuration is necessary for RACH-less based SCG activation, we can wait for RAN2.Proposal 7: The known condition for a TCI state at RACH-less SCG activation is “BFD for the TCI state is configured and no BF is detected for the TCI state”.Proposal 8: One of the conditions for RACH-less based SCG activation is that TCI state is known.Proposal 9: Delay requirement for RACH-less PSCell activation can be defined as Tconfig\_PSCell = TRRC\_delay + Tprocessing + T∆ + TIU + 2 ms, where Tprocessing = 20ms and T∆ = 1\*Trs ms.Proposal 10: For PSCell deactivation or activation from deactivated status, the existing requirements for interruption due to PSCell addition/release can be used as baseline. Proposal 11: One more slot interruption shall be considered due to asynchronous deployment compared with synchronous deployment in PSCell.Proposal 12: Use the parameter measCyclePSCell to relax the RLM/BFD requirements.Proposal 13: Use the current interruption requirement due to L3 measurement on SCell dormancy for the interruption due to L3 measurement on deactivated SCG.Proposal 14: The same principle as the interruption due to SCell dormancy is applied for Interruption requirement due to RLM and BFD on deactivated PSCell. The loss rate is 0.5%.Proposal 15: The existing Te requirement applies for the first transmission of RACH-less based SCG activation on PSCell. Proposal 16: Don’t specify Te or gradual timing adjustment requirement for deactivated PSCell. |
| [R4-2204288](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204288.zip) | OPPO | Proposal 1: RACH-less PSCell activation delay can be defined as Tconfig\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆+ TIU + 2 mswhere TIU is the interruption uncertainty in acquiring the first [PUSCH transmission]/[SR on PUCCH] occasion when UE is configured with RACH-less SCG.Proposal 2: if PSCell is added and directly enter the activated status, Tprocessing defined in PSCell addition can be reused:* Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing = 20 ms if NR PSCell is in FR1, Tprocessing = 40 ms if NR PSCell is in FR2

Proposal 3: if PSCell is added and directly enter the activated status, T∆ defined in PSCell addition can be reused: * T∆ = 0 can be expected when PSCell is activated from a deactivated status and RLM/BFD measurements is being performed in this PSCell; otherwise, T∆ = 1\*Trs ms for a known or unknown PSCell.
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| [R4-2204475](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204475.zip) | Ericsson | **Proposal 1:** * RRM requirements for deactivated SCG are based on SS-RSRP, SS-RSRQ and SS-SINR measurements with time index detection, with measurement rate depending on measCyclePSCell, the new parameter introduced which is similar to measCycleSCell.
* Measurement cycle similar as for measurements on deactivated SCell, i.e., measCycleSCell within 160 to 1280ms

**Proposal 2:** Baseline for the PScell activation delay should be defined in two scenarios. * **RACH**
	+ **TPSCell\_act = TRRC\_delay + Tprocessing + Tsearch + T∆ + TPSCell\_DU + 2 ms**
* **RACH-less**
	+ **TPSCell\_act = TRRC\_delay + Tprocessing + TIU + 2 ms**
* Tprocessing = 0ms shall be assumed at the time of activation. This assumption is similar to the assumption implicitly made for SCell activation.
* Tprocessing value can only be differ when PSCell change event trigger and PSCell activation command happened at the same time while
	1. Tprocessing = 20 ms when source and target cells are in the same FR,
	2. Tprocessing = 40 ms when source and target cells are in different FRs.
* Tsearch = 0ms The PSCell in deactivated state is in the normal scenario known to the UE.

**Proposal 3:** Interruption requirements due to RLM/BFD during deactivated SCG should consider how the measurement cycle is being configured. **Proposal 4:** The existing UE initial transmit timing error (Te) and gradual timing adjustment requirements are met at least until the TAT is running. **Proposal 5:** RAN4 further discusses whether to meet Te requirements the SSB should be available at the UE once every 160 ms or it should be available at the UE with the same rate with which the UE performs RRM requirements on PSCell once every measCyclePSCell. **Proposal 6**: The UE shall stop performing RLM on the deactivated PSCell upon detecting RLF on the deactivated PSCell.**Proposal 7:** The UE shall not perform beam failure recovery or candidate beam detection upon beam failure detection on the deactivated PSCell. **Proposal 8:** The UE shall stop performing beam failure detection if the UE has detected beam failure on the deactivated PSCell.**Proposal 9:** Inform RAN2 about the observations and proposals related to impact of RLF and BFD on the deactivated PSCell. |
| [R4-2204633](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204633.zip) | vivo | Proposal 1: The min value of measCyclePSCell could be a larger value e.g. 640ms. And the range of measCyclePSCell could be reused the range value of measCycleSCell. LS to RAN2 on RAN4 decision on min value and range of measCyclePSCell.Proposal 2: * If PSCell parameters is not modified, Tprocessing could be 1ms.
* If any PSCell parameter is modified,
	+ Tprocessing = 20ms NR PSCell is in FR1 in EN-DC.
	+ Tprocessing = 40 ms if NR PSCell is in FR2 in EN-DC or NR-DC

Proposal 3: T∆ could be different in the following scenarios:o When the previous RS for RLM/BFD was received within [1280ms], UE can obtain fine timing information from the RLM/BFD measurements and T∆ could be 0,o otherwise, UE needs to do the fine T/F tracking again and T∆ could be 1\*Trs ms.Proposal 4: When PSCell being activated is same cell as previously being deactivated, the target PSCell is always known and the Tsearch could be removed. RACH-less PSCell activation delay can be defined asTconfig\_PSCell =TRRC\_delay + Tprocessing + T∆+TIU + 2 msProposal 5: For RACH-less based SCG activation, the condition that BFD should be configured and no BF is detected needs to be satisfied (when the UE is configured to perform BFD).Proposal 6: When PSCell is activated from a deactivated status, existing requirements for interruption due to SCell activation/deactivation can be used as a baselineProposal 7: * For SCG activation/deactivation in EN-DC,

when SCG is activated/deactivated, there are no active serving cells in the SCG. The interruption on LTE MCG can refer to clause 7.32.2.4 (Interruptions at SCell addition/release) in TS 36.133.* For SCG activation/deactivation in NR-DC,

the interruption requirements can refer to existing interruptions at PSCell addition/release specified in clause 8.2.4.2.1 in TS38.133.Proposal 8: Whether RLM/BFD is configured or not, the current interruption requirement on deactivated inter-band SCC can be reused directly for L3 measurement for deactivated SCG.Proposal 9: Related to the min value of measCyclePSCell discussed in Issue 2-1-1:* If the min value of measCyclePSCell can be to 640ms or a larger value, there is no need to have further relaxation here.
* If the min value of measCyclePSCell less than 640ms, we propose to do 1.5 times or 2 times relaxation on RLM/BFD measurement of the deactivated PSCell.

Proposal 10: Interruption requirement due to RLM and BFD on deactivated PSCell could reused the same principle as the interruption due to SCell dormancy is applied ([0.5]%). Proposal 11: Timing requirement including Te and Tq don’t need to meet when PSCell is activated. As for the accuracy of UE timing, it could be guaranteed by fine time tracking discussed in Issue 2-2-3.Proposal 12: Defining the condition for known and unknown TCI state only when the UE is configured to perform BFD for deactivated PSCell. When the BFD is configured and no BF is detected, the TCI state could be known. Otherwise, the TCI state is regard as unknown.Proposal 13: The UE behaviours upon RLF and BFD on deactivated PSCell belongs to the scope of RAN2. |
| [R4-2204898](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204898.zip) | Huawei, Hisilicon | Proposal 1: The minimum value and range of measCycleSCell can be reused for new introduced measCycle on deactivated PSCell.Proposal 2: Reusing the PSS/SSS detection delay, time index delay and measurement period on deactivated SCell with replacing measCycleSCell with measCyclePSCell (the IE name depends on RAN2).Proposal 3: UE processing time (Tprocessing) in PSCell activation delay is 10ms.Proposal 4: T∆ =1\*Trs ms in PSCell activation delay.Proposal 5: RACH-less PSCell activation delay can be defined as Tconfig\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆ + TIU + 2 ms, provided that-TAT is running and is regarded as valid when the SCG is switched from activated to deactivated state;-TCI state for PDCCH/PDSCH reception is indicated in SCG activation indication, or the previous activated TCI states is valid and can be used.where * Tsearch is the time for AGC settling and PSS/SSS detection. If the target cell is known, Tsearch = 0 ms. If the target cell is unknown and the target cell Ês/Iot ≥ -2dB, Tsearch = 24\* Trs ms.
* Tprocessing and T∆ refer to proposal 3 and proposal 4 respectively.

Proposal 6: For SCG activation/deactivation, the existing requirements for interruption due to SCell activation/deactivation can be used as a baseline.Proposal 7: For SCG activation/deactivation in ENDC,* When SCG is activated (i.e., PSCell is activated), there are no active serving cells in the SCG. The interruption on LTE MCG can refer to clause 7.32.2.5 (Interruptions at SCell activation/deactivation) in TS 36.133.

For SCG activation/deactivation in NR-DC, the interruption requirements can refer to existing interruptions at activation/deactivation specified in clause 8.2.4.2.2 in TS38.133, where sync and async scenario has different interruption length.Proposal 8: Interruption due to RRM measurement on deactivated SCG follows * + If RLM/BFD is not configured, the current interruption requirement during measurements on deactivated inter-band SCC applies.
	+ If RLM/BFD is configured, the current interruption requirement during Scell dormancy applies([X]%).

Proposal 9: Not to consider RLM/BFD relaxation on deactivated PSCell in R17.Proposal 10: Interruption requirement due to RLM and BFD on deactivated PSCell: The same principle as the interruption due to SCell dormancy is applied ([0.5]%).Proposal 11: Timing requirements including Te and Tq don’t need to be specified when PSCell is deactivated.Proposal 12: The discussion on UE behaviour upon RLF and BFD on deactivated PSCell is left to RAN2. |
| [R4-2205647](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205647.zip) | Nokia, Nokia Shanghai Bell | 1. The value range for the measurement cycle for a deactivated PSCell should include 40ms and 80ms.
2. The full value range for the measurement cycle for the deactivated PSCell should be: [40, 80, 160, 256, 320, 512, 640, 1024, 1280].
3. Capture the proposed Time period for PSS/SSS detection, deactivated PSCell (FR1 and FR2) in section 9.2.5.1.
4. Capture the proposed Time period for Index detection, deactivated PSCell in section 9.2.5.1.
5. Capture the proposed Measurement period for intra-frequency measurements without gaps (deactivated PSCell) (FR1 and FR2) in section 9.2.5.2.
6. Existing measurement reporting requirements, e.g. in 9.2.4, applies for a deactivated PSCell.

UE processing time (Tprocessing) in PSCell activation delay1. Tprocessing is only defined for PSCell addition.
2. Tprocessing is not needed for PSCell activation.
3. PSCell activation delay shall not include Tprocessing when PSCell is activated from deactivated state.
4. PSCell activation delay should allow UE RF warm up delay.
5. RAN4 need to discuss and agree on a suitable RF warm delay for PSCell activation.
6. RAN4 to define separate parameter to account for the RF warm up delay when PSCell is activated from deactivated state – TRF\_warmup.

Time/frequency tracking time (T∆) and Tsearch in PSCell activation delay1. If the UE has been configured to perform link recovery procedure (BFD) on the deactivated PSCell and the UE has not detected any beam failure, the DL beam can be assumed known.
2. If the UE has been configured to perform radio link monitoring (RLM) on the deactivated PSCell and the UE has not detected any RLF, the cell can be assumed known.
3. Tsearch at activation depends on the PSCell conditions at activation.
4. A UE configured to perform RLM and BFD on the deactivated PSCell: when PSCell is activated, if UE has not declared RLF or BFD (TCI state is known), Tsearch = 0 while time frequency tracking is allowed. Hence, Tsearch = 0, T∆ = 1xTrs.
5. A UE configured to perform RLM on the deactivated PSCell: when PSCell is activated, if UE has not declared RLF (PSCell is known), Tsearch =0, while additional time for beam search (L1-RSRP) and time frequency tracking is allowed. Hence, Tsearch = TL1-RSRP, measure, T∆ = 1xTrs.
6. A UE configured to perform RLM on the deactivated PSCell: when PSCell is activated, if UE has declared RLF (PSCell is unknown), Tsearch =24xTrs, and additional time for beam search (L1-RSRP) and time frequency tracking is allowed. Hence, Tsearch = 24xTrs, TL1-RSRP, measure, T∆ = 1xTrs.
7. During PSCell activation UE is allowed T∆.
8. During PSCell activation, if UE is configured with RLM/BFD, Tsearch is conditioned the RLM and BFD status.

Known and unknown conditions for PSCell activation1. The definition for known PSCell conditions for a deactivated PSCell to include the PSCell RLM condition when UE is performing RLM on a deactivated PSCell.

Known and Unknown TCI state for PSCell activation1. The definition for known TCI state conditions for a deactivated PSCell to include the PSCell BFD condition when UE is performing BFD on a deactivated PSCell.

Requirements for PSCell activation delay1. Define one generic PSCell activation delay covering both RACH based and RACH less PSCell activation delay.
2. PSCell activation delay requirement differentiation between RACH-based and RACH-less will be accounted by the parameter TPSCell\_ DU.
3. Requirements for RACH-less PSCell activation delay: TActivation\_PSCell = TRRC\_delay + TRF\_warmup + Tsearch + T∆ + TPSCell\_ DU + TRS\_processing ms
4. Requirements for RACH based PSCell activation delay: TActivation\_PSCell = TRRC\_delay + TRF\_warmup + Tsearch + T∆ + TPSCell\_ DU + TRS\_processing ms
5. RACH-less based PSCell activation delay requirements are included in the generic PSCell activation delay requirement.
6. If a BFD has occurred, and TCI state is unknown, and RACH-less activation of PSCell may not be possible.

Interruption due to PSCell activation/deactivation1. When a PSCell is activated from a deactivated status, the interruption requirements for SCell activation/deactivation for inter-band DC/CA applies (Table 8.2.4.2.2-1).

Interruption due to PSCell activation/deactivation in asynchronous deployment1. RAN4 defines interruption requirements PSCell activation and deactivation for asynchronous deployment.
2. When a PSCell is activated from a deactivated status in asynchronous deployment, the interruption requirements for SCell activation/deactivation for inter-band DC/CA applies (Table 8.2.4.2.2-1).

Interruption due to L3 measurement on deactivated PSCell1. A UE configured to perform L3 measurements, the interruption requirements in NR-DC as defined in section 8.2.4.2.3 can be re-used.
2. A UE configured to perform L3 measurements and RLM or BFD, the interruption requirements defined for a dormant SCell in section 8.2.2.2.12.3 can be re-used.

Whether RLM/BFD delay requirements on deactivated PSCell can be relaxed1. Use the existing principles of for RLM/BFD measurements and requirements. Hence, the RLM/BFD measurements and requirements follow the measurement cycle of the deactivated PSCell (measCyclePscell).
2. the rate of ACK/NACK feedback loss on any serving cell resulting from RRM measurements on deactivated PSCell shall not exceed [0.5/1.0]%.

Others1. Define the UE transmit timing requirements for a deactivated PSCell at activation.
2. UE initial transmission timing error applies to a PSCell when being activated.
3. Currently we do not see any need for RAN4 actions related to UE behaviour upon RLF and BFD on deactivated PSCell.
 |

## Open issues summary

### Sub-topic 2-1: Measurement requirements for deactivated SCG

**Issue 2-1-1: Min value and range for measCyclePSCell**

* Proposals
	+ Option 1(Apple, MTK, Ericsson, Huawei): existing min value and range of measCycleSCell can be reused for measCyclePSCell (i.e., {sf160, sf256, sf320, sf512, sf640, sf1024, sf1280})
	+ Option 2 (QC, vivo):

The minimum value of measCyclePSCell shall not be smaller than the minimum value of measCycleSCell,

* + - Option 2a(QC): preferably 320ms as the minimum value, that is

{sf320, sf512, sf640, sf1024, sf1280}

* + - Option 2b (vivo): preferably 640ms as the minimum value, that is

{sf640, sf1024, sf1280}

* + Option 3 (Nokia): add 40ms and 80ms, the range is {sf40, sf80, sf160, sf256, sf320, sf512, sf640, sf1024, sf1280}
* Recommended WF
	+ Further discussion

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We support Option 2 but agree that there doesn’t seem to be a compelling reason why the minimum value of measCyclePSCell shall be larger than that of measCycleSCell.Option 1 is acceptable to us. |
| Intel | Option 1 is good enough. We support Option 1. |
| MTK | Option 1. As PSCell is more important than SCell, the minimum value of measCyclePSCell should be no larger than measCycleSCell to ensure that deactivated PSCell is measured no less than SCell in any cases. In addition, considering that CSSF of PSCell is no larger than CSSF of SCell and the goal of introducing measCyclePSCell is for power saving, we suggest the minimum value of measCyclePSCell to be 160ms which is the same as measCycleSCell and the maximum value of SSB period. |

**Issue 2-1-2: Intrafrequency cell identification for deactivated PSCell**

* Proposals
	+ Option 1 (Nokia): the following requirements for deactivated PSCell are specified:
		- Capture the proposed Time period for PSS/SSS detection, deactivated PSCell (FR1 and FR2) in section 9.2.5.1:
* **Table 9.2.5.1-x1:** **Time period for PSS/SSS detection, deactivated PSCell (FR1)**

|  |  |
| --- | --- |
| measCyclePSCell | TPSS/SSS\_sync\_intra |
| measCyclePSCell ≥ 40ms | Ceil(5 x Kp) x measCyclePSCell x CSSFintra |

* **Table 9.2.5.1-x2: Time period for PSS/SSS detection, deactivated PSCell (FR2)**

|  |  |
| --- | --- |
| measCyclePSCell | TPSS/SSS\_sync\_intra |
| measCyclePSCell ≥ 40ms | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x measCyclePSCell x CSSFintra |

* + - Capture the proposed Time period for Index detection, deactivated PSCell in section 9.2.5.1:
* **Table 9.2.5.1-x3: Time period for time index detection, deactivated PSCell (FR1)**

|  |  |
| --- | --- |
| measCyclePSCell | TSSB\_time\_index\_intra |
| measCyclePSCell ≥ 40ms | Ceil(3 x Kp)x measCyclePSCell x CSSFintra |

* Recommended WF
	+ Further discussion

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We don’t support Option 1 because DRX is missing. |
| MTK | Similar view with QC. When DRX cycle is larger than measCyclePSCell, the delay is even shorter than active PSCell. We think this is not reasonable. |

**Issue 2-1-3: L3 measurement period on deactivated PSCell**

* Proposals
	+ Option 1 (QC):
		- T\_SMTC is replaced by measCyclePSCell;
		- A greater number between the configured DRX for SCG and a fixed number, e.g. 320ms, replaces it for measurement relaxation while the SCG is deactivated
	+ Option 2(MTK, Ericsson, Huawei): specified as deactivated SCell by replacing measCycleSCell with measCyclePSCell.
	+ Option 3(Nokia): specified as deactivated SCell by replacing measCycleSCell with measCyclePSCell. **However only measCyclePScell applies and configured DRX for activated state is not applicable.**

One example (in below) is given for option 3 where requirements for DRX are not applicable herein:

Table 9.2.5.2-y1: Measurement period for intra-frequency measurements without gaps (deactivated PSCell) (FR1)

|  |  |
| --- | --- |
| measCyclePSCell | T SSB\_measurement\_period\_intra  |
| measCyclePSCell ≥ 40ms | Ceil(5 x Kp)x measCyclePSCell x CSSFintra |

* Recommended WF
	+ Further discussion

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | The first bullet of Option 1 is effectively the same as Option 2 because Option 1 is based on active serving cell while Option 2 is based on deactivated SCell.For the second bullet of Option 1, along the lines of measurement relaxation for deactivated PSCell, we still believe configured DRX for SCG is not immediately applicable from measurement requirement perspective. For example, even when a short DRX cycle is configured, while SCG is deactivated, measurement doesn’t have to be determined based on the configured short cycle. |
| MTK | Option 2. Since we have measurement requirements for deactivated SCell already and introduce a measCycleSCell like parameter measCyclePSCell, it is straight forward to use the requirements for deactivated SCell as baseline and replace measCycleSCell with measCyclePSCell. Even when a short DRX cycle is configured or DRX is not configured, the measurement is determined by measCyclePSCell. So we don’t think the second bullet of Option 1 is necessary.Regarding Option 3, when DRX cycle is larger than measCyclePSCell, deactivated PSCell is measured even more frequently than active PSCell. We think this is not reasonable. |

**Issue 2-1-4: L3 measurement on deactivated SCell in deactivated SCG**

* Proposals
	+ Option 1(QC): measCycleSCell is replaced by max(measCyclePSCell, measCycleSCell)
* Recommended WF
	+ Further discussion

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | An SCell in deactivated SCell does not have to be more frequently measured that deactivated PSCell. |
| MTK | We understand the motivation but don’t support it. If there are multiple SCells, it is reasonable that NW may configure a smaller measCycleSCell than measCyclePSCell as CSSF for SCell is larger. |

### Sub-topic 2-2: SCG Activation/deactivation delay

***Moderator’s note: The following issues are to be discussed under the case that PSCell is activated from deactivated state.***

**Issue 2-2-1: UE processing time (Tprocessing) in PSCell activation delay**

* Proposals
	+ Option 1 (Apple, vivo): If any PSCell parameter is modified,
		- Tprocessing = 20ms NR PSCell is in FR1 in EN-DC.
		- Tprocessing = 40 ms if NR PSCell is in FR2 in EN-DC or NR-DC

Otherwise:

Option **1a** (Apple): Tprocessing = 10ms

Option **1b** (vivo): Tprocessing =1ms

* + Option 2 (MTK, Ericsson):

For the case that PSCell change and PSCell activation command happen simultaneously

- Tprocessing = 20 ms when source and target cells are in the same FR,

- Tprocessing = 40 ms when source and target cells are in different FRs.

For PSCell activation from deactivated state,

Option **2a** (MTK): Tprocessing =20ms.

Option **2b** (Ericsson): Tprocessing =0ms.

* + Option 3 (QC): UE processing time (Tprocessing) in PSCell activation delay is
* Tprocessing = 10ms NR PSCell is in FR1 in EN-DC
* Tprocessing = 20 ms if NR PSCell is in FR2 in EN-DC or NR-DC
* If any PSCell parameter is modified, Tprocessing shall not be less than 20ms.
	+ Option 4 (OPPO):
		- Tprocessing = 20ms NR PSCell is in FR1 in EN-DC.
		- Tprocessing = 40 ms if NR PSCell is in FR2 in EN-DC or NR-DC
	+ Option 5 (Huawei): Tprocessing = 10ms
	+ Option 6 (Nokia):
		- If the PSCell is activated from deactivated state, Tprocessing is not applicable as delay parameter.
		- PSCell activation delay should allow UE RF warm up delay
		- RAN4 need to define a separate parameter accounting the RF warm up delay- TRF\_warmup.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | Support Option 3. We can’t accept any number smaller than 10ms which effectively makes it harder for UE to save power consumption although a relative gain in terms of activation latency is already achieved by introducing deactivated SCG state where lots of procedures can be skipped, e.g. procedures for core network resources, tunnels, bearer (PDU session) establishments, and L1/2 link setup such as TCI association and so on. |
| MTK | Since quite a number of parameters may be modified, we propose Tprocessing to be 20ms for PSCell activation to simplify the discussion. According to the existing requirement for PSCell change, if FR is changed, then Tprocessing = 40ms; otherwise, Tprocessing = 20ms. If FR is changed, it is definitely PSCell change, and Tprocessing = 40ms. Otherwise, no matter we categorise this to PSCell change or PSCell parameter modify, Tprocessing = 20ms. |

**Issue 2-2-2: time/frequency tracking time (T∆) in PSCell activation delay**

* Proposals
	+ Option 1 (Apple, QC, MTK, Huawei, Nokia): time/frequency tracking time (T∆) in PSCell activation delay is needed, and T∆ = 1\*Trs for both RACH-based and RACH-less cases.
	+ Option 2 (OPPO, vivo): T∆ = 0 when RLM/BFD measurements is being performed in this PSCell and the previous RS for RLM/BFD was received within [1280ms]; otherwise, T∆ = 1\*Trs.
	+ Option 3 (Ericsson):
		- T∆ = 0 if RLF/BFD configured, otherwise T∆ = 1\*Trs for RACH-based activation
		- RACH-less activation, as the precondition for RACH-less activation is always have the RLM/BFD configured, there is no need to keep T∆.
* Recommended WF
	+ Further discussion

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Option 1.When UE activates PSCell, the first transmission has to fulfil uplink timing accuracy requirement for which at least one SSB sample should be made available within 160ms. Here, the SSB will be used for time and frequency tracking. Therefore, one SSB for time/frequency tracking time shall be included in the activation delay. |
| MTK | Option 1. Firstly, RLM/BFD measurement on deactivated PSCell should be relaxed, and the measurement cycle can be longer than 160ms. Even Te requirement is specified under the condition that at least one SSB is available at the UE during the last 160 ms, not to mention T/F fining tracking. Secondly, time/frequency fine tracking is not always necessary for RLM/BFD. We suggest not to force UE to do T/F fining tracking quite frequently which complicates UE behavior and is not good for power saving. Thirdly, if the accuracy of time/frequency fine tracking cannot be guaranteed, the subsequent demodulation performance will be affected. Therefore T∆ = 1\*Trs ms is necessary. |

**Issue 2-2-3: whether Tsearch is needed for RACH-less based PSCell activation delay**

Moderator Note:

* + RACH-less PSCell activation delay is defined as

Tconfig\_PSCell = TRRC\_delay + Tprocessing + [Tsearch] + T∆+ TIU + 2 ms

The value of Tprocessing and T∆ depends on Issue 2-2-2 and Issue 2-2-3. This issue focus on whether Tsearch for RACH-less PSCell activation delay is needed.

* Proposals
	+ Option 1 (Apple, OPPO, Huawei): Tsearch is needed in RACH-less based PSCell activation delay
	+ Option 2 (MTK, vivo): Tsearch = 0ms in RACH-less based PSCell activation delay.
	+ Option 3 (Nokia):
		- During PSCell activation, if UE is configured with RLM/BFD, allowed T∆ is allowed and Tsearch is conditioned the RLM and BFD status:
			* A UE configured to perform RLM and BFD on the deactivated PSCell: when PSCell is activated, if UE has not declared RLF or BFD (TCI state is known), Tsearch = 0 while time frequency tracking is allowed. Hence, T∆ = 1xTrs
			* A UE configured to perform RLM on the deactivated PSCell: when PSCell is activated, if UE has not declared RLF (PSCell is known), Tsearch =0, while additional time for beam search (L1-RSRP) is allowed, Tsearch = TL1-RSRP, measure, T∆ = 1xTrs.
			* A UE configured to perform RLM on the deactivated PSCell: when PSCell is activated, if UE has declared RLF (PSCell is unknown), Tsearch =24xTrs, and additional time for beam search (L1-RSRP) is allowed. Hence, Tsearch = 24xTrs, additional TL1-RSRP, measure and T∆ = 1xTrs.
		- A UE not configured to perform either RLM or BFD on the deactivated PSCell will follow known/unknown conditions for the PSCell
	+ Option 4 (Ericsson): There is no need in RACH-less based PSCell activation, and propose to remove Tsearch
* Recommended WF
	+ Further discussion

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Option 1 unless PSCell is always known.  |
| MTK | Option 2. As valid TA is a condition for RACH-less, we doubt whether TA is still valid if the PSCell becomes unknown. In addition, this issue is related to issue 2-2-4. It is better to discuss this issue after we have an agreement on issue 2-2-4. But it seems issue 2-2-4 may depend on the outcome of RAN2. We suggest to define the delay requirement for the case that BFD is configured at first. |

**Issue 2-2-4: Conditions for RACH-less based SCG activation**

**Background**

The TA related condition was agreed in last meeting [R4-2204633]. The following discussion focus on the 2nd and 3rd bullets.

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| **Issue 2-2-6: Conditions for RACH-less based SCG activation*** Agreements
	+ RACH-less based SCG activation delay requirements shall meet the following conditions:

- TAT is running and TA is regarded as valid,- FFS: TCI state is known for both UE and network,- FFS: BFD should be configured and no BF is detected. |

* Proposals
	+ Option 1(MTK): RACH-less based SCG activation delay requirements shall meet the following conditions:

- TCI state is known for both UE and network

- Whether BFD configuration is necessary can wait for RAN2.

* + Option 2(vivo): RACH-less based SCG activation delay requirements shall meet the following conditions:

- BFD should be configured and no BF is detected.

Option 3 (Huawei): The both conditions (TCI state is known and BFD related) are Not necessary:

* Recommended WF
	+ Further discussion

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We don’t support “TCI” in Option 1. There can be a case where UE is signalled, upon PSCell activation from NW, to use a different TCI than what UE have kept measuring. And for BFD, there was the following explicit agreement on this in the last RAN2 #116-bis-e meeting:* When the UE is configured to perform RLM/BFD when the SCG is deactivated, upon reception of a network activation command not including reconfigurationWithSync while the TA timer associated with the PSCell is running and BF/RLF is not declared, the UE shall activate the SCG without performing RACH towards the SCG.

And we don’t really think side conditions where RACH-less based SCG activation is allowed should be explicitly spelled out in RAN4 spec. We believe all these will be explicitly specified in RAN2 spec. |
| MTK | Fine with Option 1 or Option 2. In our understanding, BFD configuration is the way to guarantee known TCI state, so Option 1 and Option 2 are the same to us. According to the agreement in RAN2#116bis-e meeting, they are discussing whether BFD configuration is necessary or not for RACH-less. We can wait for RAN2 or ask them for some clarification.

|  |
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| RAN2#116bis-e* 6: Discuss at the next meeting whether the UE can perform RACH-less activation if the UE is not configured to perform RLM/BFD while the SCG is deactivated.
 |

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**Issue 2-2-5: Known condition for TCI state at deactivated PSCell**

*Background:*

*Legacy known conditions in section 8.10.2 are duplicated in below.*

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| The TCI state is known if the following conditions are met:- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state- TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement - The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command- The TCI state remains detectable during the TCI state switching period- The SSB associated with the TCI state remain detectable during the TCI switching period- SNR of the TCI state ≥ -3dBOtherwise, the TCI state is unknown. |

* Proposals
	+ Option 1 (MTK, vivo, Nokia): The known condition for a TCI state at RACH-less SCG activation is “BFD for the TCI state is configured and no BF is detected for the TCI state”.
	+ Option 2 (Nokia) The definition for known TCI state conditions for a deactivated PSCell to include the PSCell BFD condition when UE is performing BFD on a deactivated PSCell
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| MTK | Option 1. As for legacy known conditions, we think it is only reasonable when PSCell is activated after being deactivated in less than 1280ms and L1-RSRP report for the target TCI state is sent to network before deactivation. The use case is quite limited. From the point of UE implementation, the known conditions in option 1 actually require UE to monitor the TCI state for deactivated PSCell implicitly. Because it is difficult for UE to judge the TCI state is detectable or not correctly if the TCI state is not monitored for 1280ms completely, especially when UE is moving fast. If BFD is configured, UE shall follow BFD requirement and UE behavior will be more testable.Similar as issue 2-2-4, since RAN2 is discussing whether BFD configuration is necessary or not for RACH-less, we are also fine to wait for RAN2 or ask RAN2 for some clarification. |

**Issue 2-2-6: known condition for PSCell activation**

* Background

The known condition was agreed in last meeting [R4-2204633].

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| In FR1 and FR2, the PSCell is known if it has been meeting the following conditions:- During the last 5 seconds before the reception of the PSCell activated command:- the UE has sent a valid measurement report for the PSCell being activated and- One of the SSBs measured from the PSCell being activated remains detectable according to the cell identification conditions specified in clause 9.3.- One of the SSBs measured from PSCell being activated also remains detectable during the PSCell activated delay Tconfig\_PSCell according to the cell identification conditions specified in clause 9.3.otherwise it is unknown. |

One company proposed to update the above agreement.

* Proposals
	+ Option 1(Nokia): add a condition on top of the conditions agreed in last meeting:
		- If configured to perform RLM on the deactivated PSCell, RLF has not been detected.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| MTK | In our logic, the condition for known cell is discussed for RACH-based SCG activation. We don't quite agree with Nokia to add this as the cell may become detectable again after RLM declared. It is different from condition for known TCI state for RACH-less based SCG activation, as RACH-less can fall back to RACH-based, but RACH-based is the last choice. |

**Issue 2-2-7: Requirements for PSCell activation delay**

In the last meeting RAN4 made common understanding related to the activation delay for RACH based PSCell activation delay:

Tconfig\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆+ **TPSCell\_ DU** + 2 ms

Where TPSCell\_ DU is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell.

\*Moderator Note: one company proposed replace Tprocessing of TRF\_warmup in Issue 2-2-2.

RACH-less PSCell activation delay is still open for further discussion.

One company propose:

* Proposals
	+ Option 1(Nokia): Define one generic PSCell activation delay requirement covering both RACH based and RACH less PSCell activation delay, where the PSCell activation delay requirement differentiation between RACH-based and RACH-less will be accounted by the parameter TPSCell\_ DU.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| MTK | We prefer to discuss the delay requirement for RACH-based and RACH less separately. In our understanding, Option 1 is more about how to capture the final agreements in spec. This can be discussed after we have reached consensus on delay requirement for RACH-based and RACH less. |

**Issue 2-2-8: Direct SCG activation for multiple cells (PSCell+SCell(s))**

Background

The following agreement is reached in last meeting [R4-2202688]

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| **Issue 2-2-8: Direct SCG activation for multiple cells (PSCell+SCell(s))*** Agreements

Focus on activation of PSCell alone at this stage. |

One company proposed to define requirements for multiple cells in this meeting. As this is the last meeting for completing the core part requirements and there is no draft CR provided on this, we shall follow the previous agreement and finalize the PSCell alone activation requirements at this meeting. Requirements for multiple Cells activation in one SCG can be further discussed in maintenance stage. Please comment on the following proposals:

* Proposals
	+ Option 1: Define requirements for SCG activation with multiple cells (PSCell+SCell(s)) during maintenance stage.
* Recommended WF

Further discussion.

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| **Company** | **Comments** |
| Qualcomm | Okay with Proposal. |
| MTK | OK with Option 1. |

### Sub-topic 2-3: Interruption requirements

**Issue 2-3-1: Baseline for interruption due to PSCell activation/deactivation**

Background: It is agreed in RAN4#101e WF [R4-2120334]

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| **Issue 2-3-1: Baseline for interruption due to PSCell activation/deactivation**If PSCell is added and directly enter the activated status* + Existing requirements for interruption due to PSCell **addition/release** can be used as baseline, i.e., 1ms interruption length.

If PSCell is activated from a deactivated status* + Option 1: existing requirements for interruption due to PSCell **addition/release** can be used as baseline, i.e., 1ms interruption length.
	+ Option2: interruption requirement for Scell activation can be reused (Table 8.2.4.2.2-1)
 |

* Proposals

If PSCell is activated from a deactivated status

* + Option 1(vivo, Huawei, Nokia): Existing requirements for interruption due to SCell activation/deactivation can be used as a baseline.
	+ Option 2 (Apple, MTK): Existing requirements for interruption due to PSCell addition/release can be used as baseline, i.e., 1ms interruption length.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | Support Option 2. |
| MTK | Option 2. Since initial UL BWP may be modified when PSCell is activated from deactivated status, parameter loading time is needed. |

**Issue 2-3-2: interruption due to PSCell activation/deactivation in asynchronous deployment.**

* Proposals
	+ Option 1 (Huawei, Nokia)

For SCG activation/deactivation in ENDC,

When SCG is activated (i.e., PSCell is activated), there are no active serving cells in the SCG. The interruption on LTE MCG can refer to clause 7.32.2.5 (Interruptions at SCell activation/deactivation) in TS 36.133.

For SCG activation/deactivation in NR-DC, the interruption requirements can refer to existing interruptions at activation/deactivation specified in clause 8.2.4.2.2 in TS38.133, where sync and async scenario has different interruption length.

* + Option 2 (MTK, vivo):

For SCG activation/deactivation in ENDC,

-When SCG is activated/deactivated, there are no active serving cells in the SCG. The interruption on LTE MCG can refer to clause 7.32.2.4 (Interruptions at SCell addition/release) in TS 36.133.

For SCG activation/deactivation in NR-DC, the interruption requirements can refer to existing interruptions at PSCell addition/release specified in clause 8.2.4.2.1 in TS38.133.

* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| MTK | Option 2. Same reason as 2-3-1. Since initial UL BWP may be modified when PSCell is activated from deactivated status, longer time is needed. |

**Issue 2-3-3: Interruption due to L3 measurement on deactivated PSCell**

**For information**

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| *8.2.1.2.15 Interruptions due to SCell dormancy [TS 38.133]**<Omit not related content>**8.2.1.2.15.2 Interruptions due to CQI measurements during SCell dormancy* *When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).* *The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.**8.2.1.2.15.3 Interruptions due to RRM measurements during SCell dormancy* *When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).**The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0%.* |

* Proposals
	+ Option 1 (Apple, Huawei, Nokia):
		- If RLM/BFD is not configured, the current interruption requirement during measurements on deactivated inter-band SCC applies.
		- If RLM/BFD is configured, the current interruption requirement during SCell **dormancy** applies ([1]%).
	+ Option 2 (MTK):
		- The current interruption requirement due to L3 measurement on SCell **dormancy** applies ([1]%).
	+ Option 3 (vivo):
		- The current interruption requirement on deactivated inter-band SCC can be reused for L3 measurement for deactivated SCG;
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | Support Option 2, and Option 1 is acceptable. |
| Intel | We are OK with Option 1. |
| MTK | Option 2 and we are also OK with Option 1.  |

**Issue 2-3-4: Interruption requirement due to RLM and BFD on deactivated PSCell**

* Proposals
	+ Option 1 (Apple, MTK, vivo, Huawei, Nokia): The same principle as the interruption due to SCell **dormancy** is applied ([0.5]%).
	+ Option 2 (Ericsson): Interruption requirements due to RLM/BFD during deactivated SCG should consider measCyclePSCell (e.g. when the configured measCyclePSCell is 640 ms or longer, 0.5% probability of missed ACK/NACK is allowed).
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | Support Option 1. |
| Intel | We also support option 1. |
| MTK | Option 1. |

### Sub-topic 2-4: RLM/BFD/BFR/Beam management on deactivated PSCell

***RAN2 status (For information)***

*It is agreed in RAN2#115e:*

*The UE performs RLM and BFD on PSCell while the SCG is deactivated if network configures it.*

**Issue 2-4-1: Whether RLM/BFD delay requirements on deactivated PSCell can be relaxed**

* Proposals
	+ Option 1a (MTK): Yes, use the parameter measCyclePSCell to relax the RLM/BFD requirements.
	+ Option 1b (Nokia): Use the existing principles of for RLM/BFD measurements and requirements. Hence, the RLM/BFD measurements and requirements follow the measurement cycle of the deactivated PSCell (measCyclePscell)**.**
	+ Option 2 (vivo):
* If the min value of measCyclePSCell can be to 640ms or a larger value, there is no need to have further relaxation here.
* If the min value of measCyclePSCell less than 640ms, we propose to do 1.5 times or 2 times relaxation on RLM/BFD measurement of the deactivated PSCell.
	+ Option 3 (Huawei): Not to consider RLM/BFD relaxation on deactivated PSCell in R17.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | Support Option 1a and 1b. And we also want to add the following.a greater number between the configured DRX for SCG and a fixed number, e.g. 320ms, is used for measurement period determination while the cell is deactivated. |
| MTK | Option 1a. |

### Sub-topic 2-5: Others

**Issue 2-5-1: whether UE shall meet the existing Te and Tq when PSCell is deactivated**

* Proposals
	+ Option 1 (Apple, MTK, vivo, Huawei): Timing requirements including Te and Tq don’t need to be specified when PSCell is deactivated.
	+ Option 2(Ericsson, Nokia): The existing UE initial transmit timing error (Te) and Tq requirements are met at least until the TAT is running.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| MTK | Option 1. |

**Issue 2-5-2: whether UE shall meet the existing Te requirement for the first transmission of RACH-less based SCG activation on PSCell**

* Proposals
	+ Option 1 (MTK, Nokia, Ericsson): The existing Te requirement applies for the first transmission of RACH-less based SCG activation on PSCell
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| MTK | Support Option 1. In our understanding, Te is applicable for all the initial transmissions from UE, so it also applies to the first transmission of RACH-less based SCG activation on PSCell. |

**Issue 2-5-3: If the answer of issue 2-5-1 and/or issue 2-5-2 is yes, conditions for meeting Te requirements**

* Proposals
	+ Option 1 (Ericsson):
* SSB should be available at the UE once every 160 ms, or
* SSB should be available at the UE with the same rate with which the UE performs RRM requirements on PSCell once every measCyclePSCell.
* Recommended WF
	+ Further discussion

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| **Company** | **Comments** |
| Qualcomm | Option 1. Whether and when UE measures SSB before the first transmission toward PSCell is up to UE implementation. |
| MTK | Ok with the first bullet but not the second one.We think we should follow the current spec “The UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms.”. |

**Issue 2-5-4: UE behaviour upon RLF and BFD on deactivated PSCELL**

* Proposals
	+ Option 1 (Ericsson):
		- The UE shall stop performing RLM on the deactivated PSCell upon detecting RLF on the deactivated PSCell.
		- The UE shall not perform beam failure recovery or candidate beam detection upon beam failure detection on the deactivated PSCell.
		- The UE shall stop performing beam failure detection if the UE has detected beam failure on the deactivated PSCell.
	+ Option 2(vivo, Huawei, Nokia): The UE behaviours upon RLF and BFD on deactivated PSCell belongs to the scope of RAN2
* Recommended WF
	+ Further discussion

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Option 2. |
| MTK | Option 2. |

## CRs/TPs comments collection

*For close-to-finalize Wis and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing Wis, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2203746Draft CR (Apple) | Company A |
| Company B |
|  |
| R4-2203747Draft CR (Apple) | Company A |
| Company B |
|  |
| R4-2204289Draft CR (OPPO) | Company A |
| Company B |
|  |
|  |
| R4-2204290Draft CR (OPPO) | Company A |
| Company B |
|  |
| R4-2204345 (MTK) | Company A |
| Company B |
|  |
| R4-2204416Draft CR (Intel) | Company A |
| Company B |
|  |
| R4-2204417Draft CR (Intel) | Company A |
| Company B |
|  |
|  |
| R4-2204632Draft CR (vivo) | Company A |
| Company B |
|  |
|  |
| R4-2204899Draft CR (Huawei) | Company A |
| Company B |
|  |
|  |
| R4-2205648Draft CR (Nokia) | Company A |
| Company B |
|  |
|  |
| R4-2204478 Draft CR  (Ericsson) | Company A |
| Company B |
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LS draft

|  |  |
| --- | --- |
| R4-2204477LS to RAN2(Ericsson) | Company A |
| Company B |
|  |
|  |
| R4-2204633LS draft in Appendix(vivo) | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #3: Conditional PSCell change and addition

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2204900 | Huawei | Draft CR |

## Open issues summary

No open issues. For the draft CR, please directly comment in section 3.3

## CRs/TPs comments collection

*For close-to-finalize Wis and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing Wis, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2204900Draft CR (Huawei) | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Huawei | Jing Han  | hw.hanjing@huawei.com |
| Intel | Meng | Meng.zhang@intel.com |
|  |  |  |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)