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

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

**Agenda item:** 10.22

**Source:** Huawei, HiSilicon

**Title:** WF on R17 further Multi-RAT Dual-Connectivity enhancements

**Document for:** Approval

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

*Note: The content marked with green highlight is what was agreed in 1st round discussion.*

## 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.**

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.

*In the 1st round discussion, one company proposed to add one condition: UE receives the SCell activation command and TCI state activation command at the same time. Further discuss whether the additional statement is aggreeable:*

* Option 1(QC): Add one additional condition: UE receives the SCell activation command and TCI state activation command at the same time.

***Please provide further comments on the above option 1***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 1 because Tuncertainty\_MAC is removed from the requirements. In this case, “UE receives the SCell activation command and TCI state activation command at the same time” should be added just like legacy SCell activation requirement does. |
| Apple | Option 1 is fine for us. Agree with the observation. RAN4 needs to either agree on option 1 or add Tuncertainty\_MAC back. |
| Nokia | We do not see a problem in allowing the UE the additional time receiving the TCI state activation command if this is not provided in the same MAC command as the SCell activation command. However, it should be added as additional delay and not a condition for the requirements to apply. |
| MTK | We are a bit confused about Option 1. If UE receives the SCell activation command and TCI state activation command at the same time, Tuncertainty\_MAC=0 even in the legacy requirement. Just to confirm whether our understanding is right, aren’t we discussing issue 1-1 for the case SCell activation command and TCI state activation command are not received at the same time?If we are not wrong, we are fine if limit the case to “UE receives the SCell activation command and TCI state activation command at the same time” and we don’t need to discuss issue 1-1.We are also fine with Nokia to add option 1 as additional delay. |
| Huawei | Option 1 is fine for us, as it is the same as legacy. |
| Ericsson | Our understanding is the Scell activation command and TCI state activation command are at the same time, as this is only choice after RAN2’s agreement, even though RAN1 has an alternative option that activation command and TCI activation command could be with sperate MAC\_CE.We don’t see the reason to add one additional condition, which basically is the limitation of RAN1 alternatives. We rather agree with Nokia, if additional conditions needed, then it should be added additional delay. |

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

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

Define requirements of multiple SCell activation enhancement during maintenance stage.

**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**

* + Option 1(QC, MTK, Huawei, Apple, Ericsson): the following can be a starting point.

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

*As this part would be further discussed in maintenance part, no further discussion in 2nd round in this meeting.*

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

* + Option 1(QC, MTK, Huawei): the following can be a starting point.

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.

*As this part would be further discussed in maintenance part, no further discussion in 2nd round in this meeting.*

# Efficient activation/de-activation mechanism for one SCG

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

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

* + Option 1(Apple, MTK, Ericsson, Huawei, QC, Intel, Apple, OPPO): existing min value and range of measCycleSCell can be reused for measCyclePSCell (i.e., {sf160, sf256, sf320, sf512, sf640, sf1024, sf1280})
	+ Option 2b (vivo): The minimum value of measCyclePSCell shall not be smaller than the minimum value of measCycleSCell, {sf640, sf1024, sf1280}
	+ Option 3 (Nokia): add 40ms and 80ms, the range is {sf40, sf80, sf160, sf256, sf320, sf512, sf640, sf1024, sf1280}

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We don’t support Option 3. Unlike deactivated SCell, PSCell measurement opportunities won’t be shared with other cells proportionally to the number of SCell. Therefore, we do not see any compelling reason to lower the value further. |
| Apple | Support option 1. Don’t see the necessity of shorter periodicity. As we mentioned in the 1st round, measurement on deactivated PSCell is still prioritized over measurement on other SCC according to existing CSSF design. Thus, mobility of measurement on deactivated PSCC can still be guaranteed. |
| Nokia | To progress the work we can support option 1. |
| MTK | Support 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.  |
| Huawei | Support option 1. Don’t see the strong motivation to increase the lower bound of PSCell, as PSCell is more important than SCell. So option 2b is not preferred. For option 3, we had the same view as QC and Apple. |
| vivo | For the sake of progress, we can compromise to Option 1. |
| Ericsson | Support option 1 |

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

* + Option 1 (Nokia, Apple): 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 |

* + Option 2(QC, MTK, Huawei, Ericsson, vivo): DRX configuration shall be considered

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We don’t support Option 1. DRX cycle should be still used for measurement cycle/requirement determination. Otherwise, measurement requirement for deactivated SCG will be unnecessarily tightened. In extreme case, measurement frequency of deactivated SCG can be higher than that of activated SCG, which does not make sense to us. |
| Apple | We prefer option 1 but we can compromise to option 2 for the sake of progress, even though we haven’t seen any convincing evidence so far to link measurement on deactivated PSCell with DRX configuration. We believe the case QC mentioned “measurement frequency of deactivated SCG can be higher than that of activated SCG” only results from unsuitable NW configuration, e.g. DRX is quite long however, measCyclePSCell is quite short. That should not be the direction of discussion. Otherwise, people can also argue that option 2 is also problematic since activation/deactivation is triggered via RRC and network can update the DRX configuration e.g. from a long DRX to a short DRX once the PSCell is deactivated. Obviously, this is still allowed from RRC signal perspective but it definitely not a proper way to deactivate the PSCell. |
| Nokia | We cannot support option 2 as it is unclear which DRX configuration is referred to.Can supports of option 2 provide views on which DRX configuration they refer to: PCell/MCG DRX configuration or PSCell/SCG DRX configuration? |
| MTK | Option 2. The delay requirement for deactivated PSCell should not be shorter than active PSCell. |
| Huawei | Thanks Apple for compromise.We support option 2. If a SCG is deactivated from active state, the DRX configuration would still exist for the deactivated SCG, as DRX doesn’t be de-configured when UE enters to deactivated state. In this case, it is possible that the DRX cycle is larger than measCyclePSCell and it is not unsuitable configuration. Then the measurement frequency of deactivated SCG can be higher than that of activated SCG which is not reasonable.To Nokia, I think the DRX configuration refers to SCG own DRX configuration. |
| vivo | Support Option 2. Regrading to the comments from Nokia, we have two points to clarify:Firstly, we think the typical case for updating the DRX configuration is from a short DRX to a long DRX. Even if the DRX is updated to a short value, the time period for PSS/SSS detection (deactivated PSCell) will depend on the max (measCyclePSCell,1.5xDRX cycle) rather than DRX cycle only. Secondly, the deactivated SCG has its own DRX cycle and it would refer to SCG DRX configuration. |
| Ericsson | We support option 2.In clarification, the DRX configuration should be applicable per CG group as specified in the existing requirements. The DRX configuration here is the configuration of SCG DRX configuration as it is the PSCell. |

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

* + Option 2(MTK, Ericsson, Huawei, vivo, QC): specified as deactivated Scell by replacing measCycleSCell with measCyclePSCell.
	+ Option 2a (QC): on top of option 2, add the following:
		- 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 3(Nokia, Apple): 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 |

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We don’t support Option 3. With Option 2a, we want to further avoid cases where UE has to perform measurements frequently even when PSCell is deactivated just because UE is configured with a small value of DRX cycle to be used for activated PSCell. |
| Apple | We can compromise to option 2. |
| Nokia | Cannot agree to either of options 2 or 2a.Same discussion as for Issue 2-1-2. |
| MTK | Option 2. |
| Huawei | We support option 2.The concern on option 3 is the same as issue 2-1-2.For option 2a, the case spotted by QC can be addressed by configuring a suitable measCyclePSCell value if the DRX cycle is small. In addition, if the measCyclePSCell minimum value is 160ms (if option 1 in issue 2-1-1 is agreed), the frequent measurement on deactivated PSCell can be also avoid to some extent. |
| vivo | Support Option 2. |
| Ericsson | We support option 2. |

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

* + Option 1(QC): measCycleSCell is replaced by max(measCyclePSCell, measCycleSCell)
	+ Option 2 (MTK, Nokia, Huawei, Apple, Ericsson, vivo): use the legacy SCell measurement requirement.

***Recommended WF: agree on option 2.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We can withdraw our support for Option 1 given the drawbacks mentioned by companies in the first round. |
| Apple | Support option 2. |
| Nokia | Support option the recommended WF.This would be aligned with the current principles used in RAN4 for deactivated cells. |
| MTK | Option 2. |
| Huawei | Support option 2. |
| vivo | Support Option 2. We would like to follow the legacy requirement. |
| Ericsson | We support option 2. |

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

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

**GTW session (February 24, 2022)**

* Agreements
	+ When PSCell is activated from deactivated state
		- If any PSCell parameter is modified
			* Tprocessing = [20ms].
		- Otherwise
			* Tprocessing = [5 or 10ms].
		- Note: further discuss if Tprocessing or a different term shall be used

***Further discuss below in 2nd round***

* + When PSCell is activated from deactivated state
		- If any PSCell parameter is modified
			* Tprocessing = [20ms].
		- Otherwise
			* Option 1: Tprocessing = 5 ms.
			* Option 2: Tprocessing = 10ms.
		- Note: further discuss if Tprocessing or a different term shall be used

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We support Option 2.In the current form of the tentative agreement, we don’t even consider whether to-be-activated PSCell is in the same FR as MGS or not. To us, Option 2 looks already a very challenging value considering this is a minimum requirement. We agree that there can be cases where circumstances allow UE to be able to activate PSCell way faster than Option 2. In such a case, NW will anyway receive PRACH or SR on PUCCH on the to-be-activated PSCell earlier than expected from requirement spec, hence, Option 2 does not mean there will be always additional 5ms delay compared to Option 1 until PSCell gets activated. |
| Apple |  Support option 2, which is already a tightened solution even though latency reduction at RAN is not the major enhancement in this topic.  |
| Nokia | We cannot agree to use the word Tprocessing as it will lead to unclear UE requirements. We do not have any problems defining the necessary delay requirements for the UE but the reasoning and the delays need to be clear. We are fine to split Tprocessing into warm up time for the RF. Additional delays can be specified based on PSCell conditions.If one or more parameters have been modified, it can be discussed further how this impact and the required delay at PSCell activation. However, we still think 20ms is far to relaxed, and RAN4 need to discuss the reasoning and justification for such long delay.As for Tprocessing when no parameters have been modified, we still need the technical justification for such 5/10ms based on what is the RAN4 understanding of the definition of the delay. We can compromise to the time provided the delay is well defined (Tprocessing is not well defined at all for PSCell activation but only an assumed delay inherited from PSCell addition as we see it). This will also provide clear delay requirements. As mentioned, we see that the actual PSCell conditions should form the base for defining the PSCell activation delay. |
| MTK | Option 2. |
| Huawei | Prefer option 2 (option 1 is also acceptable). This highly depends on UE implementation. As the requirements defined in TS38.133 are minimum requirements, we prefer to cover all kinds of implementation. In addition, the requirements in spec don’t restrict UE to implement faster. |
| vivo | Both Option 1 and Option 2 are fine with us. |
| Ericsson | We support Option 1.As the parameter change has already been out of this scenario, we really don’t see for the case of activate from deactivated status, why we need so long time of UE Processing.Our understanding, the UE will have transmitting during deactivated SCG status, this is the before activation preparation. For RACH based activation, this would be pre-ambles, and for RACH-less it is either PUCCH or CSI reporting at PUSCH. If these fulfil the time alignment requirement, when UE maintain sync without any parameter change, we don’t see any other case there would be any slower case then 0ms. Since if anything that cannot fulfil this precondition, might not be able to fit in the activation/deactivation case. It can be using the PScell addition requirement which include a full processing delay. We understand there might be some warming up time needed beside the parameter updates, so Option 1 is already a compromise from the 0ms we proposed. |

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

*Majority companies can agree on option 1. One company supports option 3.*

*No tentative agreement.*

*Candidate options:*

* + Option 1 (QC, MTK, Nokia, Huawei, Apple, OPPO, vivo): time/frequency tracking time (T∆) in PSCell activation delay is needed, and T∆ = 1\*Trs for both RACH-based and RACH-less cases.
	+ 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∆.

**Recommendations WF：**

**Agree on option 1.**

 ***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support recommended WF. |
| Apple | Support option 1. |
| Nokia | We can agree to allowing UE time for fine time/frequency tracking at PSCell activation in general. However, this it provided ‘Tprocessing’ definition and that this delay is not covering the same.We the agreement of ‘Tprocessing’, T∆ and Tsearch as being a package solution. Hence, it not possible to fully agree on one parameter without clear understanding of the overall activation delay and each delay parameter/part.RAN4 need to discuss the overall PSCell activation delay together including all needed delays and conditions – as a package. |
| MTK | Support recommended WF. |
| Huawei | Support recommended WF.Disagree on option 2. During 1st round discussion, relaxed RLM/BFD was agreed (as PSCell is introduced). then the RLM/BFD evaluation period would be larger than 160ms, so the T/F tracking shall be performed even if RLF/BFD is configured.  |
| vivo | Support Option 1. |
| Ericsson | As our understanding T∆ is time for fine time tracking and acquiring full timing information of the target cell.We understand option 1 is trying to take the same requirement from legacy requirement for PScell addition, TS38.133 clause 8.9.2.However, we would still argue that SCG activation/deactivation is very different from PScell addition, since during the activation and deactivation, what UE stop is the PDCCH monitoring due to there is no other Scell and traffic while PScell addition, is to acquire a new PScell. While for activation of the PScell, during the deactivated SCG, UE still maintain mobility for measurement, at the short period before activation command, UE still transmit either pre-amble for RACH based or PUCCH/PUSCH or RACH-less activation. Anything transmitting during this deactivated status as long as it fulfil time alignment requirement, with RLM/BFD configured, which will constant check whether UE is maintain synchronization we really don’t understand why this T∆ is needed.For the case when there is no RLM/BFD configured, we can compromise to 1 sample for the fine time tracking.From our point of view this is already a compromise proposal, but for the progress of the WI we can compromise to reach agreement. |

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

**GTW session (February 24, 2022)**

* Agreements
	+ Case 1: RLM and BFD are configured and no failure is detected
		- Option 1A
			* Tsearch = 0 ms if the target cell is ‘known’
			* Tsearch = [X] ms if the target cell is ‘unknown’
		- Option 1B:
			* Tsearch = 0 ms provided that TBD side conditions are fulfilled
	+ Case 2: RLM and BFD are not configured
		- Tsearch is FFS
	+ Note: whether Case 2 shall be supported may be revisited based on RAN2 decision

***Further discuss below in 2nd round***

* + Case 1: RLM and BFD are configured and no failure is detected
		- Option 1A
			* Tsearch = 0 ms if the target cell is ‘known’
			* Tsearch = [X] ms if the target cell is ‘unknown’
		- Option 1B:
			* Tsearch = 0 ms provided that TBD side conditions are fulfilled

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 1A. |
| Apple | Support option 1A. X can be same as existing requirements in other sections, e.g. in section 8.9.2 for PSCell addition delay requirements.As we mentioned in the 1st round, there is a gap between RLF/BF and ‘unknown’. There are some timers and counters in RLM/BFD evolution, which are specifically used to increase robustness. However, the robustness can also results in additional latency for RLF/BF. Once the target cell becomes ‘unknown’ but RLF/BF is not triggered yet, UE may have lost the T/F tracking. In this scenario UE cannot meet Te requirement in the first UL transmission after receiving activation command from NW.  |
| Nokia | Case 1:As discussed related to the other Issues we believe that RAN4 should define the PSCell activation delay based on the PSCell condition at the activation time. This would be aligned with principle normally used in RAN4. If the UE is performing BFD on the PSCell and no failure has been detected our view is that this would mean that the UE link is still good and there wouldn’t be a need for additional Tsearch time. As no BFD has occurred and UE has to monitor the PSCell closely it is not clear to us how the PSCell would not be known? If there is a certain time between bad channel conditions occurring and until BF is declared, we believe this can be covered by adding conditions (as also done for SCell activation).If the UE is performing RLM only on the PSCell and no RLF has been delcared our view is that this would mean that the UE cell link is still good and there wouldn’t be a need for a full cell search (detection) delay and some Tsearch time can be allowed for the UE.The known and unknown conditions would need further discussion as we also provided views on in the 1st round discussion.Option B is not clear enough in its current form. |
| MTK | Option 1B. In our understanding, as long as the beam is detectable, UE can perform RACH-less based SCG activation. Otherwise, UE should perform RACH based SCG activation. So the side condition can be Ês/Iot of the beam corresponding to the TCI state ≥ -2dB.For SCell activation, the requirement for unknown SCell is applicable under the condition that the side condition Ês/Iot ≥ -2dB is fulfilled. If we go to Option 1A, the same side condition will be needed. We want to point out that the side condition for BF when specifying test cases is “Ês/Iot < -6dB”. If Ês/Iot ≥ -2dB, it means no BF and Tsearch is not needed. If not, there will be no requirement according to the logic for SCell activation. |
| Huawei | The latest agreement from RAN2 is duplicated:C:\Users\h00388629\AppData\Roaming\eSpace_Desktop\UserData\h00388629\imagefiles\99D98EBF-BF40-4B9F-9962-544A9D76AD47.pngTherefore only case 1 needs to be focus.We know one view is that during RLM/BFD monitoring, the cell/beam become undetectable, however the RL/beam failure is not indicated to L3 due to long timer configuration. The UE behaviour during the special duration has not been discussed before (Deactivated SCell has no beam monitoring). Another view is that the side condition between Tsearch for unknown case and RLM/BFD is mismatched. Even if UE perform cell detection, the SINR shall be less than -6dB where no requirements are specified.Based on the current situation, is the following trade-off acceptable? It means there is no requirement for target cell unknown case.* + Case 1: RLM and BFD are configured and no failure is detected
		- Option 1C
			* Tsearch = 0 ms if the target cell is ‘known’
 |
| vivo | Firstly, we think it is necessary to distinguish known cell conditions from the known TCI state conditions. Further, the value of Tsearch and the known conditions for PSCell activation should decouple with the configuration of the RLM and BFD. In our understanding, whether the target cell is known or not depends on the known and unknown conditions for PSCell activation. The PSCell could be known if it has been meeting the following conditions agreed in RAN4#101bis-e.

|  |
| --- |
| We support Option 1C.Also wants to clarify Option 1B, the other condition is to quote from TS38.133 Claus 8.9.2 PScell addition.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.This chapter also defined what are the known and unknown condition which is discussed in Issue2-2-6.We think the condition for activation SCG would be different from PScell addition. So whether 24 sample is needed for PScell activation. Since now the PScell has already been configured, and when we have RLM/BFD configured without and failure declare, this is very different from adding a new PScell.  |

Secondly, we think the value of Tsearch can reference the search time in the SCell activation delay requirement for deactivated SCell. If the unknown PSCell being activated belongs to FR1, Tsearch could be 1\*Trs. If the PSCell belongs to FR2, Tsearch = 8\* Trs.On the basis of the above points, we propose to the revised option:* When the target cell is known,
	+ Tsearch = 0ms
* When the target cell is unknown,
	+ Tsearch = 1\* Trs for FR1
	+ Tsearch = 8\* Trs for FR2
 |
| Ericsson | We support Option 1C.We think the condition for activation SCG would be different from PScell addition. So whether 24 sample is needed for PScell activation for unknown scenario still need FFS. Since now the PScell has already been configured, and when we have RLM/BFD configured without and failure declare, this is very different from adding a new PScell.  |

* + Case 2: RLM and BFD are not configured
		- Option 1: Tsearch is needed
	+ Note: whether Case 2 shall be supported may be revisited based on RAN2 decision

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 1. |
| Apple | We are fine with option 1 in case 2. However, we would like to mention that even if RLM and BFD are not configured (if supported by RAN2) , Tsearch can also be 0 if target cell is known. In this sense, it seems no need to differentiate case 1 and 2. It is the matter of whether target cell is known or not. |
| Nokia | Case 2:We are fine waiting RAN2 if RLM/BFD need to be configured or not. If RLM/BFD configuration for deactivated PSCell is optional (our understanding is that it is optional) RAN4 would of course need to define requirements such scenario as well.Our current view in this case the PSCell activation delay would not differ much from SCell activation delay.We can support option 1 and agree that we can include Tsearch but the length of Tsearch would depend on the conditions when PSCell is activated. Anyway, the overall delay needs to be agreed as a package. |
| MTK | According to RAN2’s agreement below, we don’t need to discuss case 2 anymore.

|  |
| --- |
| * 5: If the UE is not configured to perform RLM/BFD while the SCG is deactivated, the UE always performs RACH upon receiving an SCG activation command.
 |

 |
| Huawei | Same comments as MTK. No need to further discuss on case 2. |
| vivo | There is no need to discuss on case 2. |
| Ericsson | Agree there is no need of further discussion. |

**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.

|  |
| --- |
| **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. |

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

- BFD should be configured and no BF is detected.

* + Option 3 (QC, Nokia, Huawei, Apple, Ericsson): as the conditions of RACH-less PSCell activation would be explicitly defined in RAN2, RAN4 not to discuss this.

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 3. |
| Apple | Support option 3. |
| Nokia | As minimum this would need further discussions including RAN2. However, in general we support option 3. |
| MTK | Since RAN2 already has an agreement on this issue, we can compromise to Option 3. |
| Huawei | Based on the latest agreements in RAN2, Option 2 and option 3 are the same meaning. We prefer RAN4 directly refer to RAN2 condition of RACH-less PSCell to avoid duplication. |
| vivo | According to the latest agreements in RAN2, we think the condition in Option 2 is convincing. Besides, Option 3 is OK for us. |
| Ericsson | Option 3 |

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

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”.

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

*Background*

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

|  |
| --- |
| 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. |

* 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.
	+ Option 2 (MTK, Apple, OPPO, Ericsson, vivo): don’t add the condition proposed in option1.

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | We still don’t see the necessity of linking RLM and known condition together. However, we are open to further discussion, e.g. if the concerns from companies in the 1st round can be addressed. |
| Nokia | Option 1.The agreed known condition for PSCell is based on the definition used for PSCell addition. In PSCell addition scenario the PSCell is added as new serving cell and likely based on a measurement report from the UE triggered by an inter-frequency measurement event. Hence, the reporting delay is the network way to known the cell is available and can be used PSCell. The additional conditions re then added to ensure reasonable UE conditions to ensure that if the reported cell is added as PSCell the addition delay only applies under reasonable conditions.However, when we discuss PSCell activation when the UE has been configured to perform RLM on the deactivated SPCell the situation is different. Now the PSCell is already configured and a serving cell – and the UE is performing radio link evaluation on the PSCell. In this case, if the RLM has not been declared on the PSCell the PSCell is still known to the UE. At least, if no RLF has occurred on the deactivated PSCell, the needed delays for activating the PSCell should be shorter as there is no need for a full search delay including up to 24\*Trs. From a network point view, to provide additional gain from having the UE performing RLM on the deactivated PSCell, the PSCell activation should also account when no RLF has occurred on the deactivated PSCell.We proposed capturing this in under the known conditions for the PSCell, but we can discuss as part of conditions when defining the overall PSCell activation delay. |
| MTK | Option 2. We prefer not to link known cell condition with RLM.The side condition to trigger RLM is Ês/Iot < -10dB for test cases. But the requirement for unknown SCell is applicable under the condition that Ês/Iot ≥ -2dB which is much higher than -10dB. For RACH base SCG activation, the delay requirement uses that of PSCell addition as a baseline. We can use the known conditions for PSCell addition as well. |
|  Huawei | Prefer to decouple RLM and known condition. As Apple’s comments, before RLF/BF is indicated (due to the long timer of RLM and BFD), it is possible that UE become unknown. We admit the case exists.  |
| vivo | Don’t Support Option 1. There are two reasons below.Firstly, when RLM is based on CSI-RS, even if the Option 1 is added as the condition for PSCell activation, it cannot ensure that the SSBs measured remain detectable.Secondly, when RLM is based on SSB, it may not ensure that RLM-RS is the SSB that used to measure. |
| Ericsson | Option 2 |

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

*During 1st round discussion, 6 companies prefer to discuss RACH-based and RACH-less separately. One company prefer to define one generic PSCell delay requirement covering both RACH-based and RACH-less.*

* + 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.

 *From moderator’s view, technically RACH-less and RACH-based have many different aspects. As this is the last meeting for core part completion, Moderator suggest not to further discuss this and focus on detailed requirements definition.*

Discuss RACH-based and RACH-less PSCell activation delay separately, and focus on detailed requirements definition.

***With the above clarification, check Nokia’s view whether the above yellow highlight is acceptable.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia |  |
| Apple | No strong view. Fine with moderator’s recommendation. |
| Nokia | We can discuss further. But currently it is not clear what RACH-less activation really means and how it is handled (RAN2 and/or RAN4).Hence, we do not think we need any further agreement for now but we can continue the discussion. Our view is that for clear RAN4 requirements one PSCell activation delay requirements based on the conditions at the activation time seems reasonable. Access method is then a potential additional delay. |
| vivo | Fine with moderator’s recommendation. |

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

Define requirements for SCG activation with multiple cells (PSCell+Scell(s)) during maintenance stage.

## Sub-topic 2-3: Interruption requirements

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

If PSCell is activated from a deactivated status

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

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 2. |
| Apple | Support option 2. |
| Nokia | Option 1 with the same arguments as earlier. This is PSCell activation and not addition. We should keep the principles clear in RAN4. |
| MTK | Option 2. Since some RF parameters may be modified, longer time is needed. |
| Huawei | Support option 2 as in issue 2-2-1, Tprocessing is not zero even when no parameters are modified. |
| vivo | Support Option 2. |
| Ericsson | Option 1. |

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

* + Option 1 (Nokia, Ericsson)

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, Huawei, Apple, 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.

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 2. |
| Apple | Support option 2. |
| Nokia | Option 1 with the same arguments as earlier. This is PSCell activation and not addition. We should keep the principles clear in RAN4. |
| MTK | Support option 2. |
| Huawei | Support option 2. |
| vivo | Support Option 2. |
| Ericsson | Support option 1. |

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

* + 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]%).

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

* + Option 1 (QC, Intel, MTK, Nokia, Huawei, Apple, vivo): 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).

**Recommendations WF：**

**Agree on option 1.**

 ***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Recommended WF. |
| Apple | Support the recommended WF. |
| Nokia | Option 1.  |
| MTK | Support the recommended WF. |
| Huawei | Support the recommended WF. |
| vivo | Support the recommended WF. |
| Ericsson | We can compromise to the recommended WF. |

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

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

* + Option 1 (QC, Nokia, Huawei, Apple, Ericsson): Yes, use the parameter measCyclePSCell to the RLM/BFD requirements on deactivated PSCell.
	+ Option 1a (QC): on top of option 1, add the following:
		- 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
	+ Revised Option 2 (vivo):

-If the min value of measCyclePSCell can be to 320ms or 640ms, there is no need to have further relaxation here.

-If the min value of measCyclePSCell less than 320ms, 2 times relaxation on RLM/BFD measurement of the deactivated PSCell.

***Please provide further comments on the above options.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 1. With Option 1a, we want to further avoid cases where UE has to perform measurements frequently even when PSCell is deactivated just because UE is configured with a small value of DRX cycle to be used for activated PSCell. |
| Apple | Support option 1. |
| Nokia | Option 1 |
| MTK | Support option 1. |
| Huawei | Support option 1. Option 2 is a new proposal raised in 1st round discussion, and we don't see any strong reason to have a new and different way to define RLM requirements. |
| vivo | We support Option 2. The case mentioned by QC is exactly what we intend to avoid. One point we are concerned about is, when max (measCyclePSCell, DRX cycle) is less than 320ms, the loss rate (0.5%) applied for Interruption requirement due to RLM and BFD on deactivated PSCell may cause some problems. Hence, we would like to have two times relaxation on RLM/BFD measurement for deactivated PSCell if the min value of measCyclePSCell less than 320ms. For this purpose, we can also compromise to support Option 1a. |
| Ericsson | Option 1. |

## Sub-topic 2-5: Others

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

*Note: This issue is not for first transmission when deactivated PSCell is activated. The first transmission issue is issue 2-5-2.*

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

***Recommended WF:***

***Agree on option 1.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Option 1. |
| Apple | Support option 1. |
| MTK | Support option 1. |
| Huawei | Support option 1.This issue is not for first transmission when deactivated PSCell is activated. The first transmission issue is issue 2-5-2. In this issue, there is no uplink data transmission on deactivated PSCell. The procedure is not able to be verified.  |
| vivo | Support Option 1. |
| Ericsson | We can compromise however we need to have some input Just to clarify, what we proposed here it is mainly for the first transmission of both RACH and RACH-less SCG activation on PScell.During deactivated status, for the UE first transmission before activation, if it is RACH based activation, it will be the pre-amble in PRACH, if it is RACH-less activation, it will be either PUCCH or CSI reporting depends on whether there is data.From network point of view, anything that is transmitting should fulfil time alignment requirements otherwise, there will be issues for base station.According to existing requirements, TS38.133 Clause 7.1.2The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.1.2-1. This requirement applies:- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission..This validates the reason why we need this time alignment requirement.However, the current specification is applicable for DRX cycle, here we are introducing the measCyclePScell, our view is that, this should be added accordingly to the specification to make sure UE fulfil this requirements. |

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

The existing Te requirement applies for 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**

* SSB should be available at the UE once every 160 ms, or
* FFS: SSB should be available at the UE with the same rate with which the UE performs RRM requirements on PSCell once every measCyclePSCell.

***Please provide further comments on the second bullet.***

***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Do not support FFS. |
| Apple | Prefer not to have the FFS part.  |
| Nokia | It is not clear what the FFS is about if the shortest measCyclePscell is 160ms. It needs to be clarified what ‘available at the UE’ means. We believe existing requirement would be sufficient. |
| MTK | Do not support FFS. The first bullet is sufficient. |
| Huawei | Don’t see strong justification to have the second bullet.  |
| vivo | Prefer not to have the FFS part. |
| Ericsson | We can compromise to remove the FFS part |

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

* + 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(QC, MTK, Nokia, Huawei, Apple,vivo): The UE behaviours upon RLF and BFD on deactivated PSCell belongs to the scope of RAN2

**Recommendations WF：**

**Agree on option 2.**

 ***(The below table is to be moved to 2nd round summary and removed in the formal WF)***

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Agree with Recommended WF. |
| Apple | Support the recommended WF. |
| Nokia | Option 2 |
| MTK | Support the recommended WF. |
| Huawei | Support the recommended WF. |
| vivo | Support Option 2. |
| Ericsson | We can compromise as we address this issue as question to RAN2 for clarification. |

# Work split

As the below requirements are agreed to be developed in maintenance phase, the work split is provided. Please add your name on the topic you are interested in, thank you in advance.

* requirements of multiple SCell activation enhancement (discussed in topic #1)
* requirements for SCG activation with multiple cells (PSCell+Scell(s)) (discussed in topic #2)

|  |  |  |
| --- | --- | --- |
|   | **Responsible company** | **Comments** |
| **Temporary RS based SCell activation** |
| A-TRS based SCell activation and deactivated delay requirements with multiple downlink SCells |  | Both activation and deactivation delay shall be considered |
| Interruptions at A-TRS based SCell activation/deactivation with multiple downlink SCells | Huawei | There are both TS 38.133 and TS 36.133 CRs |
| **Efficient activation/de-activation mechanism for one SCG** |
| SCG activation delay with PSCell and SCell (s)  |  Nokia |  |
| Interruptions due to SCG activation with PSCell and SCell (s) |  Apple | There are both TS 38.133 and TS 36.133 CRs |  |