**3GPP TSG RAN WG4 Meeting #101-bis-e** [R4-220xxxx](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_101-e/Docs/R4-2115398.zip)

**Electronic Meeting, Feb.21th-March 5th, 2022**

**Agenda Item: 10.11.2.1**

**Source: Intel**

**Title: WF on R17 NR MG enhancements – Pre-configured MG**

**Document for: Approval**

# **Introduction**

This WF is to capture all agreements and open issues for Pre-configured MG in RAN4#102e meeting based on email discussion [102-e][218] NR\_MG\_enh\_2.

# **Sub-topic 1: Pre-MG configuration**

#### **Issue 1-1: The exact configuration of Pre-MG used for PRS measurement**

Tentative agreement in the 1st round:

* UE shall inform the network about UE is going to perform/stop PRS with the configured Pre-MG only if UE has not informed NW before Pre-MG configuration. And it is also up to the network decide to activate/deactivate the current Pre-MG or configure other legacy MG to UE.
* RAN4 can inform this agreement to RAN2

Recommendation WF: Check the tentative agreements.

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| **Company** | **Comments in the 2nd round** |
| Apple | Support the tentative agreement. |
| Xiaomi | Support the tentative agreement |
| Huawei  | Already resolved in the LS discussion. |
| MTK | We can follow LS conclusion. No need to discuss this here. |
| Nokia | We support the tentative agreement. |
| Intel | Follow LS conclusion |
| Qualcomm | Agree with MTK. Follow the LS conclusion. |
| ZTE | Support the tentative agreement. |
| CATT | Fine with the tentative agreement.  |
| OPPO | Support the tentative agreement |
| vivo | Ok with the tentative agreement |
| E/// | Support the tentative agreement |
| Moderator | The tentative agreements can be agreed. And LS to RAN2 was also approved. |

# **Sub-topic 2 Pre-MG activation/deactivation**

#### **Issue 2-1 Additional trigger events for pre-MG activation/deactivation**

GTW agreements:

* + For UE autonomous pre-MG activation/deactivation the following trigger events may change the pre-MG activation status
		- BWP switching by DCI/Timer based
		- Activation/de-activation of SCell(s)
		- Addition/removal of any measurement object(s)
		- Addition/release/change of a Scell under CA
		- BWP switching by RRC
		- *FFS on Initiation of LocationMeasurementIndication in the maintenance stage*

Candidate options:

* Option 1: “LPP positioning request” event is supported
* Option 2: “LPP positioning request” event is NOT supported

Recommendation WF: Companies can provide the views whether “LPP positioning request” event can be taken counted as one of additional trigger events for UE autonomous pre-MG activation/deactivation.

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| **Company** | **Comments in the 2nd round** |
| Apple | Support option 1. We understand concern from proponents of option 2 that LPP is transparent to NW. however, it doesn’t mean this LPP cannot change the status of Pre-MG. One example, UE which is only capable of autonomous Pre-MG activation is operating with Pre-MG OFF. Then UE receives LPP and needs to perform PRS measurement. According to issue 1-1, UE shall indicate NW that it is going to perform PRS measurement and expect the Pre-MG to be ON. Since the UE is only capable of autonomous Pre-MG then NW doesn’t need to reconfigure anything (assuming the Pre-MG can cover PRS). Both NW and UE shall consider the Pre-MG to be ON until PRS measurement is done. Thus, in our view LPP indeed can change the status of Pre-MG. |
| CMCC | On one hand, we understand that LPP is transparent to NW. On the other hand, according to the tentative agreement issue 1-1, UE shall inform the network about UE is going to perform/stop PRS with the configured Pre-MG if UE has not informed NW before Pre-MG configuration, which means NW is formed whether there is PRS measurement. Taking above into account, we are OK with Option 1, or one possible way to move forward is to update the wording like “UE inform the network about the start/stop of PRS measurement with the configured Pre-MG” as the trigger event. |
| Xiaomi | Support option 1, as agreed in issue 1-1, NW shall be informed with LPP measurement request if UE has not been informed NW before Pre-MG configuration. |
| Huawei  | We have similar view CMCC, and we suggest an update to option 1 (option 1a):*“Initiation of LocationMeasurementIndication procedure” is supported as a trigger event.*We agree with companies’ views that LPP is transparent to the serving cell, so it is more proper to use the RRC procedure as the trigger event. |
| MTK | Support Option 1.Issue 1-1 can be considered together with Option 1. |
| Nokia | We support option 1. We have same understanding as Apple.  |
| Intel | We can support Option 1 or 1a. |
| Qualcomm | Option 2.The gap status cannot change unless both the network and the UE know about it. Therefore, a location request itself cannot be a trigger. If a UE receives a location request via LPP can it trust that the gap will be activated without taking any action? No, it cannot.Instead of discussing this issue, we should discuss the following:* How would the UE and network both know when a pre-configured gap needs to be activated all the time (always ‘ON”) because the UE needs to perform positioning measurements, if
	1. Autonomous rules are used
	2. RRC signallng approach is used

For either a or b, the first step is the UE sending LocationMeasurementIndication to the network.Can the UE then assume that the gap will be turned ON? In our view, it cannot assume so unless it gets some confirmation from the network.In case b, the confirmation is an RRC message that either activates the pre-configured gap or replaces it with a ‘legacy’ measurement gap.In case a, what would be the confirmation? How would the UE know when to turn on the gap if it doesn’t have confirmation from the network? It’s not clear to us.[Moderator: Firstly, for the additional trigger events, we assumed they are applied for the autonomous mechanism only here. We don’t expect UE can get any confirmation on the pre-MG status in case of pre-MG autonomous activation/deactivation. Otherwise, such events can be same as the RRC reconfiguration procedure for measurement gap configuration. It is unnecessary to define trigger events.] |
| ZTE | Support Option 1a proposed by Huawei. We have similar view in our tdoc, if PRS request should be considered as a trigger event, “LPP positioning request” should be replaced by some RRC signaling, such as the signaling referred in Issue 1-1. |
| CATT | Fine with option 1a.  |
| OPPO | Share the similar concern as QC. The confirmation from the network is unclear to UE. The option 1a proposed by Huawei could be a proper way, which can be considered. |
| E/// | Fine with option 1a. |
| Moderator | Option 1a is actually same as the issue 1-1. And since there was several technical concerns on this additional trigger events, from the moderator perspective, this additional event can be FFS in the maintenance stage.  |

#### **Issue 2-2: Pre-MG activation/deactivation criteria**

Agreement in the 1st round:

* No need to define reference table to clarify the bridge between pre-MG activation/deactivation rules to the existing generic rules for gap-less or gap based measurement in TS38.133 in the clause to define these criteria (9.1.2A )

# **Sub-topic 3 Pre-MG activation/deactivation under CA**

#### **Issue 3-1: Criteria for the signaling-based Pre-MG (de)activation under CA (How to combine the individual per-BWP pre-MG status)**

Agreement in the 1st round (the revision text from draft LS):

* An additional ON/OFF indication for each SCell is needed to indicate the Pre-configured MG status when the SCell is de-activated.
* For per-UE Pre-configured MG,
	+ the UE determines that the Pre-configured MG is ON (activated) if the Pre-configured MG status indication for the active DL BWP for any of the activated CCs is ON, or if the additional status indication for any of the deactivated SCCs is ON,
	+ otherwise, the UE determines that the Pre-configured MG is OFF (deactivated)
* For per-FR Pre-configured MG,
	+ the UE determines that the Pre-configured MG is ON (activated) if the Pre-configured MG status indication for the active DL BWP for any of the activated CCs is ON, or if the additional status indication for any of the deactivated SCCs in the corresponding FR is ON,
	+ otherwise, the UE determines that the Pre-configured MG is OFF (deactivated)

#### **Issue 3-2: How to determine pre-MG (de)activation status when multiple trigger events happened**

Tentative agreements in 1st round:

* How NW determine the gap status the is up to NW implementation itself.
* When RAN4 define the pre-configured MG activation/deactivation trigger conditions, all the events shall be taken count into by UE together.
* For RAN4 requirements perspective, UE behavior under multiple trigger events happened can be FFS in the 2nd round discussion.

*Recommendations for 2nd round:* Check the tentative agreements

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| **Company** | **Comments** |
| Apple | In our view, if multiple events occur at the same time, UE can NW need to determine the Pre-MG status after the procedure is complete. For example, if multiple Scells are being activated simultaneously, Pre-MG status shall be determined according to the status (of each CC, MO and etc) after multiple Scells activation delay. |
| CMCC | For the tentative agreements, for the third bullet “from RAN4 requirements perspective, UE behavior under multiple trigger events happened can be FFS”, we would like to hear companies’ views on the UE behavior for this case. |
| Huawei | We assume the pre-MG status should be determined based on the status of all serving cells and all MOs **after all the concurrent trigger events finish**. We understand this is already the case by following existing requirements, so we do not see clear need to define additional requirements or UE behaviour, but we are open to hear other views. |
| MTK | We agree with Huawei’s comment that the existing agreement (e.g., UE checks all CCs and all MOs) has already address the case of simultaneous multiple triggering evens. No more discussion seems needed.  |
| Nokia | We have same understanding as Apple and Huawei. In our view, this also applies in case of simultaneous LPP request and DCI/timer based BWP switching or RRC based trigger event.  |
| Intel | We agree that in principle UE can justify pre-MG status based on all events. And we maybe need not any further discussion and agreements on this since the drafting CR itself can reflect UE behavior sufficiently.  |
| Qualcomm | First of all, the first bullet point in the tentative agreement would only make sense if RRC signalling is used to determine the status of the gap. When autonomous rules are used, both the UE and network have to agree on what should happen. It cannot be up to network implementation.Regarding multiple events, in our view the comments from Apple and Huawei make sense, at least conceptually. It seems that there is alignment between various companies at least at the high level. The question we have is what constitutes multiple events? Do they have to be part of the same procedure, as suggested by some of the examples above? If not, does it matter how close/far apart in time they are from each other? When we say “all the events shall be taken count into by UE together,” it would be clear what “all” means if the events are part of a single procedure or a single command. What about other cases?  |
| ZTE | We believe all agreed trigger events means UE would determine the status of pre-MG based on all events. If multiple events happening simultaneous, the status of pre-MG should be determined after all concurrent events finish. So maybe not any further discussion on this issue is necessary. |
| CATT | Same view as Huawei. The Pre-MG status should be determined after all events finished and no need to further define the UE behavior or requirements.  |
| vivo | To our understanding, multiple events could be multiple events simultaneously triggered by one RRC signaling or MAC CE, agree that at the top level the Pre-MG status should be determined after all related events finish. |
| E/// | If at least one of the triggered events requires use of measurement gaps, then pre-MG should be ON. If all the triggered events result in no need for measurement gaps, then pre-MG is OFF. |
| Moderator | We believe that companies have same common understanding on these “multiple trigger events” which are the trigger events which can be happened simultaneously or overlapped in time domain. On the other as the UE behavior was already taken count into the current requirements for pre-MG (e.g. the pre-MG activation/deactivation rules), we need NOT to discuss them individually and reach any agreements on this in this meeting. And if the more complicated scenarios for these multiple trigger events, the further discussion can be taken in the maintenance stage.  |

# **Sub-topic 4 RRM requirements**

#### **Issue 4-1-1: Start point of Activation/Deactivation delay triggered by events other than DCI-based/timer BWP switching**

Agreements in the 1st round:

* In case of pre-MG activation/deactivation triggered by events other than DCI-based/timer BWP switching, the starting time of the gap status changing delay is the slot that UE receives the network command which leads to gap status change.

#### **Issue 4-1-2: Start point of Activation/Deactivation delay triggered by timer BWP switching**

Tentative agreements in 1st round:

* For timer based BWP switching, the pre-MG activation/deactivation delay starts from the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after a BWP-inactivity timer bwp-InactivityTimer expires on a serving cell.

*Recommendations for 2nd round:* Check the tentative agreements

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| **Company** | **Comments** |
| Apple | No objection ot the tentative agreement. Please companies check if this can be covered the following wording in the CR (yellow highlighted is newly added in this meeting, others were endorsed in last meeting):

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| The requirements in this clause only apply to the case that the DCI/timer-based BWP switch is performed on a single CC with more than one BWP configurations configured.When BWP switch occurs, which results in status change of pre-configured measurement gap according to clause [9.1.2A], UE shall be able to finish pre-configured activation or deactivation within [5] ms after the completion of the active BWP switch. |

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| Huawei | After clarification with CATT, we are fine with the tentative agreement.We are also fine with Apple’s suggestion on how to capture it in the spec. |
| MTK | Fine with both the tentative agreement and Apple’s text proposal |
| Nokia | We agree to the tentative agreement in 4-1-2 and to Apple’s suggestion. Regarding issue 4-1-1, a clarification is needed in case of Pre-MG activation after LPP request. In our view the 1st round agreement should be refined as follows in case option 1 in issue 2-1 is agreed.* In case of pre-MG activation/deactivation triggered by events other than DCI-based/timer BWP switching, the starting time of the gap status changing delay is the slot that UE receives the network command which leads to gap status change, **or in case of the LocationMeasurementIndication procedure the slot the UE receives the network acknowledgement**.
 |
| Intel | Fine with both the tentative agreement and Apple’s text proposal |
| Qualcomm | The tentative agreement is not very clear to us. We can agree with the text proposal from Apple, and we would suggest to edit the last sentence as follows: “The UE shall be able to finish activation or deactivation of the pre-configured gap within [5] ms after the completion of the active BWP switch.”Regarding Nokia’s comment: “**in case of the LocationMeasurementIndication procedure the slot the UE receives the network acknowledgement**.” Could Nokia clarify what would be the network acknowledgement**?** |
| ZTE | Fine with both the tentative agreement and Apple’s text proposal |
| CATT | Support the tentative agreement and fine with Apple’s text proposal. The text implied the starting point is same as that in timer based BWP switching which is aligned with the tentative agreement.  |
| Apple | Ok with the tentative agreements. |
| vivo | Ok with the tentative agreement |
| E/// | Ok with the tentative agreement |
| Moderator | The tentative agreements can be agreed. And how to implement this in CR can follow Apple’s proposal  |

**Issue 4-1-3: Pre-MG Activation/Deactivation Delay trigged by SCell activation/deactivation**

Agreements in the 1st round:

* If the Pre-MG activation/deactivation is triggered by MAC-CE, the overall delay is Scell activation/deactivation delay +ΔT (5ms).

**Issue 4-1-3a: Pre-MG Activation/Deactivation Delay trigged by RRC**

Agreements in the 1st round:

* If the Pre-MG activation/deactivation is triggered by RRC, the overall delay is RRC processing delay +ΔT (5ms).

**Issue 4-1-4: Pre-MG Activation/deactivation delay under CA**

Agreements in the 1st round:

* When DCI/timer-based BWP switching triggered pre-MG activation/deactivation, the Pre-MG activation/deactivation delay for CA shall be the same as for single CC

**Issue 4-2-1: UE behavior when pre-MG status changed**

Tentative agreements in 1st round:

* Define UE behaviour for the measurement with pre-MG if there is pre-MG status switching as follows:
	+ For measurements that can be performed both out of and within MG, the UE is allowed to restart the measurement performed with pre-MG if there is pre-MG status switching during the measurement period.
	+ For measurements can only be performed within MG( e.g. NR positioning measurements and CSI-RS inter-frequency measurements), measurement requirements would NOT apply if the pre-MG status changed (activated 🡪deactivated) during the measurement period

*Recommendations for 2nd round:* Check the tentative agreements

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| **Company** | **Comments** |
| Apple | Ok with the tentative agreements. |
| CMCC | For the 1st sub-bullet, it seems that the UE behaviour is mandate to restart the measurement if there is pre-MG status switching during the measurement period, we are not sure about this. Considering it is more like a UE implementation issue, we would like to hear UE vendors’ views. On the other hand, it is related with issue 4-2-2. If the tentative agreement in Issue 4-2-2 is acceptable by the group, it seems that there is no need to specify the UE behaviour for this case. I mean the 1st sub-bullet in Issue 4-2-1can be removed if tentative agreements in Issue 4-2-2 is agreeable. |
| Xiaomi | Fine with the tentative agreement |
| Huawei  | We have similar concern as CMCC on the first bullet. In our view, there is no need to mandate UE to restart since some UE may choose to continue the discussion. Our suggestion would be * + For measurements that can be performed both out of and within MG, the UE may (or is allowed to) restart the measurement performed with pre-MG if there is pre-MG status switching during the measurement period.
 |
| MTK | For 1st bullet, we can say “UE is allowed”.The 2nd bullet is straightforward. Nothing else UE can do. |
| Nokia | Both tentative agreements are ok in general. But the case that the pre-MG status changes from OFF to ON during measurement period seems not covered, yet. We propose following modification of first bullet:* For measurements that can be performed both out of and within MG, the UE shall restart the measurement performed with pre-MG **or without pre-MG,** if there is pre-MG status switching during the measurement period.
 |
| Intel | We are fine with CMCC and Huawei’s proposal to reword the first bullet to allow more flexible UE implementation. |
| Qualcomm | We are OK with the tentative agreement with the modification proposed by Huawei.To address Nokia’s point it could be rewritten as follows: For measurements that can be performed both out of and within MG, the UE may (or is allowed to) restart the measurements ~~performed with pre-MG~~ if there is pre-MG status switching during the measurement period |
| ZTE | We do not agree with 1st bullet. We have same view as CMCC, the mandatory restart operation is not aligned with the tentative agreements in Issue 4-2-2. |
| CATT | Fine with Huawei’s revision. And fine the second bullet.  |
| Apple | Ok with the tentative agreements. |
| vivo | Support Huawei’s revision on the 1st bullet. Ok with other bullet.  |
| E/// | Ok with the tentative agreements or proposed wording from HW. We prefer to use ‘is allowed to’, as used typically in the spec with some updated wording as follows: * For measurements that can be performed both outside MG and within MG, the UE is allowed to restart the measurement performed with pre-MG if there is pre-MG status switching during the measurement period.
 |
| Moderator | The revision of tentative agreements can be agreed. |

**Issue 4-2-2: General principle to define the requirements of measurement period with pre-MG measurements**

Tentative agreements in 1st round:

* RAN4 does not specify measurement period requirements for scenarios in which there are changes in the activation/deactivation status of the pre-configured MG during the measurement period.

*Recommendations for 2nd round:* Check the tentative agreements

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| **Company** | **Comments** |
| Apple | Ok with the tentative agreements. |
| CMCC | Ok with the recommended WF. |
| Xiaomi | Fine with the recommended WF |
| Huawei | We are fine with the tentative agreement. |
| MTK | Support the tentative agreement. |
| Nokia | Ok with the tentative agreement. |
| Intel | Support the tentative agreement. |
| Qualcomm | Support the tentative agreement. |
| ZTE | Support the tentative agreement. |
| CATT | Fine with the tentative agreement.  |
| vivo | Fine with the tentative agreement. |
| E/// | Fine with the tentative agreement. |
| Moderator | The tentative agreements can be agreed. |