**3GPP TSG RAN WG4 Meeting #100-e R4-21xxxxx**

**Electronic Meeting, August 16-27, 2021**

**Agenda item:** 9.11.2.1

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [100-e][224] NR\_MG\_Part\_2

**Document for:** Information

# Introduction

The scope of this email discussion is UE RRM requirements for NR positioning from the following agenda items:

* AI 9.11.2.1 Pre-configured MG pattern

In providing comments, companies are encouraged to:

* Be concise
* Provide comments on all topics/sub-topics of interest
* Ensure that comments are inserted in the latest version of the document by checking the folder before uploading
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# Topic #1: Pre-configured MG pattern(s)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2111995**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111995.zip) | CATT | **Proposal 1: The pre-configured MG can be applied for CSI-RS L3 measurement and PRS measurement.****Proposal 2: The parameters used to indicate the pre-configured MG (de)activation status per UE/FR can be configured, which can be also served as the flag to differentiate with the legacy MG.** **Proposal 3: NW can fully control whether the pre-configured MG will be activated/deactivated.** **Proposal 4: UE can know pre-configured MG’s (de)activation status through the RRC information of pre-configured gap.** **Proposal 5: The pre-configured MG is transformed into legacy MG when it is activated.** **Proposal 6: It should be considered whether the legacy gap is still needed after the pre-configured gap is defined.****Proposal 7: No need to define such criteria in the spec if the NW indication was included in pre-configured MG configuration.** **Proposal 8: For activation/deactivation of pre-configured MG, status indication is needed through the DCI for triggering BWP switch or new DCI/MAC CE/RRC after BWP switch.** **Proposal 9: The activation/deactivation of the pre-configured MG without BWP switch is out of WID scope.** **Proposal 10: No additional transition time is needed for the pre-configured MG activation/deactivation. The activation/deactivation delay of preconfigured MG is BWP switching delay.** **Proposal 11: If BWP switch occurs and the pre-configured MG is activated or deactivated during the measurement period, it is preferred to define requirements based on the number of resources within gap and without gap respectively.** **Proposal 12: If pre-configured MG is deactivated, the UE shall perform measurement without MG and be able to receive and transmit in the serving cell.** **Proposal 13: The existing gap patterns (0~25) in Rel16 can be reused for the pre-configured MG** |
| [**R4-2112392**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2112392.zip) | MediaTek inc. | **Proposal 1: When both pre-MG and PRS measurement are configured to UE, UE assumes the pre-MG status is always activated (ON) and the status will not change****Proposal 2: When pre-MG is configured together with CSI-RS based L3 measurement, UE assumes the pre-MG is always activated (ON)****Proposal 3: Introduce a single bit for existing MeasGapConfig to transform the legacy gap into pre-MG (detail to be left to RAN2).****Proposal 4: The pre-MG should be active (ON) if UE is configured with any MO that needs to be measured with gap, including inter-frequency MO, inter-RAT MO or any intra-freq MO with SSB not within UE’s active BWP. Only if none of the above conditions is fulfilled, the pre-MG should be de-actived (OFF).****Proposal 5: UE and network should automatically re-check whether to switch the status of pre-MG right upon finishing the following network commands and procedures: BWP switching, adding/removing any measurement object(s), adding/releasing/changing a PSCell, activating/de-activating any SCell(s).****Proposal 6: Additional validation time [TBD] is needed after identifying the need to change the status of pre-MG.****Proposal 7: UE re-starts a new measurement period once the pre-MG status changes. It is up to UE whether to reuse any measurement samples prior to activation/de-activation of the pre-MG** to trigger a measurement event.**Proposal 8: UE does not expect gap patterns #24 and #25 to be configured as pre-MG.** |
| [**R4-2113150**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2113150.zip) | Intel Corporation | **Observation 1**: **The gap for PRS measurement shall be activated after being configurated no matter where UE active BWP is. That is the pre-configured MG for PRS measurement is unnecessary.** **Observation 2:** **Pre-MG for PRS measurement is infeasible because it is independent with BWP switching.****Observation 3**. **The pre-configured gap can be helpful to reduce MG configuration delay for CSI-RS measurement significantly.****Observation 4: NW can prioritize the configuration of legacy MG for PRS measurement. But this is definitely up to NW implementation.*****Proposal 1: It is up to NW implementation to configure Pre-MGs for SSB/ CSI-RS / PRS measurement in Rel17.******Proposal 2: How UE can know pre-configured MG’s activation status (activated/deactivated) after the Pre-MG being configured can be based on NW signalling.******Proposal 3: The parameters used to indicate the pre-configured MG (de)activation status, which can be also served as the flag to differentiate with the legacy MG.*****Observation 5: It is feasible to include both common and specific parameters for Pre-MG in the legacy MG configuration IE which can minimize standardization impacts.*****Proposal 4：NW can configure the pre-configured MG and legacy MG independently. It is unnecessary to consider any transformation between Pre-MG and legacy MG.*****Observation 6: BWP switching is one of necessary conditions for pre-configured MG’s activation.*****Proposal 5: No need to define such criteria in the spec if the NW indication was included in pre-configured MG configuration*****Observation 7: Both UE and NW have the same understanding on the needs on the measurement gap for the measurements after BWP switching**.***Proposal 6***: ***It is feasible and efficient with autonomously/implicitly activation for preconfigured MG triggered by DCI/Timer based BWP switching.******Proposal 6a***: ***It is feasible and efficient with autonomously/implicitly activation for preconfigured MG triggered by DCI/Timer based BWP switching and under NW preconfigured indications.*** **Observation 8:** **The activation delay for pre-configured MGs shall include the BWP switching delay at least**. ***Proposal 7: RAN4 needs NOT to define the separated activation delay requirements for the pre-configured MG activation unless the BWP switching time is shorter than “gap transition time”.*** ***Proposal 8a: The RAN4 minimum requirements for intra-frequency SSB measurement can follow that of intra-frequency SSB measurement requirements with gap specified in*** *9.2.6* ***of TS38.133 [3].*** ***Proposal 8b: The RAN4 minimum requirements for intra-frequency SSB measurement and CSI-RS measurement with pre-configured MG can follow that of intra-frequency SSB measurement requirements with gap specified in*** *9.2.6* ***of TS38.133 [3] and inter-frequency CSI-RS measurement requirements specified in*** *9.10.3* ***of TS38.133 [3] respectively.*** **Observation 9: The same RF switching time when considering pre-configured gap pattern as the legacy gap patterns in NR [3] can be reused.****Observation 10: MGL of the pre-configured gap patterns can also rely on the measurement type (e.g. SSB or CSI-RS).*****Proposal 9 :* *The existing gap patterns in Rel16 [3] can be reused for the pre-configured MG depending on the configuration of the targeted measurements reference signal.*****Observation 11: It is feasible to include the pre-configured gap as one of instance of multiple concurrent gap pattern if UE supported. The more concerted discussion jointly with them can be continued in 2nd later state of this WI.**  |
| [**R4-2112421**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2112421.zip) | Xiaomi | **Proposal 1: The pre-configured MG shall be configured for CSI-RS L3 measurement.****Proposal 2: The pre-configured MG shall not be configured for PRS measurement.****Proposal 3: NW should configure the status indication per BWP to inform UE the pre-configured MG is activated or deactivated.****Proposal 4: UE should know the status of pre-configured MG on each BWP after the status indication configured by NW.** **Proposal 5: The pre-configured MG is considered as the legacy MG after it is activated, which is controlled by NW via RRC configuration.****Proposal 6: The pre-configured MG and the legacy MG can be configured independently which are considered as concurrent gaps.****Proposal 7: No need to define such criteria in the specification as long as the activation/deactivation indication is configured by NW in the pre-configured MG configuration.****Proposal 8: The pre-configured MG can be activated/deactivated autonomously triggered by DCI/Timer based BWP switching.****Proposal 9: The additional transition time between activation and deactivation of pre-configured MG after BWP switching should be considered.****Proposal 10: the total delay requirement for pre-configured MG activation/deactivation should be the DCI/timer based BWP switching delay plus the additional transition time between activation and deactivation of pre-configured MG.****Proposal 11: If there is one or more transitions between gap-based and gapless measurement during one measurement period, the relaxed measurement requirement shall be applied.****Proposal 12: The existing gap patterns (0~23) in Rel16 can be reused for the pre-configured MG.** |
| [**R4-2112069**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2112069.zip) | Apple | **Proposal 1: the assumption in R16 that PRS shall be measured within MG shall not be changed in this WI.****Proposal 2: network is not encouraged to intentionally configure Pre-MG for PRS measurement. However, as long as the Pre-MG is active and it can cover PRS, it can be used for PRS measurement.****Proposal 3: network shall not trigger any BWP switching which results in deactivation of Pre-MG before PRS measurement is finished. If the Pre-MG becomes deactivated (e.g. due to BWP switch), UE is not required to meet PRS measurement requirements.****Observation 1: as long as the Pre-MG is active, it can be used for inter-frequency CSI-RS measurement. However, under R16 CSI-RS L3 measurement structure it is unlikely that CSI-RS measurement would become inter-frequency measurement from intra-frequency measurement (vice versa) after DCI or timer-based BWP switching.****Proposal 4: Pre-MG for CSI-RS L3 measurement is not considered in this work item.****Proposal 5: The parameters used to indicate the pre-configured MG (de)activation status per BWP, which can be also served as the flag to differentiate with the legacy MG.****Proposal 6: NW can fully control whether the pre-configured MG will be activated/deactivated and UE can know pre-configured MG’s activation status (activated/deactivated) after the pre-MG being configured according to the indicated flag associated with the BWP.****Proposal 7: the configuration of Pre-MG and legacy MG shall be independent. Network can transform a pre-configured MG into legacy MG or vice versa with same MG configuration.****Proposal 8: additional transition time for pre-configure MG (de)activation can be taken count into the total pre-configured MG activation/deactivation delay beside the BWP switching delay. About 3~5ms is needed for the additional transition time.****Proposal 9: if MG happens less than the additional transition time mentioned above after BWP switching, UE is allowed to drop the measurement opportunity and longer measurement latency can be expected.** |
| [**R4-2112509**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2112509.zip) | CMCC | ***Observation 1: In Rel-16 CSI-RS based L3 measurement, only intra-frequency without MG and inter-frequency with MG is considered.******Proposal 1: the pre-configured MG can be used for CSI-RS L3 measurement, but the pre-configured MG will remain activated when there is CSI-RS based inter-frequency measurement.******Proposal 2: the pre-configured MG can be used for CSI-RS L3 measurement, but the pre-configured MG will remain deactivated when there is only CSI-RS based intra-frequency measurement.******Observation 2: PRS is assumed to be measured in measurement gap in Rel-16.******Proposal 3:the pre-configured MG can be used for PRS measurement, but the pre-configured MG will remain activated when there is PRS measurement.******Proposal 4: it is slightly preferred that the pre-configured MGs can be activated/deactivated autonomously/implicitly triggered by BWP switching.******Proposal 5: except BWP switch, other factors such the change of MO, the change of serving cell also have impact on the activation/deactivation of Pre-MG, which need to be considered.*** |
| [**R4-2112639**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2112639.zip) | vivo | **Proposal 1: For PRS measurement, use either option 1 or option 3. For CSI-RS based L3 measurement, suggest to use option 3, option 1 is acceptable.** **Proposal 2: the specific RRC configuration parameters for Pre-MG should indicate the Pre-MG (de)activation status per BWP, which can be also served as the flag to differentiate with the legacy MG, i.e., option 2. A LS should be sent to RAN2 to trigger the signalling design from RAN2.** **Proposal 3: NW can fully control whether the pre-configured MG will be activated/deactivated after configuration. UE can know pre-configured MG’s activation status (activated/deactivated) after the pre-MG being configured, no extra signalling is needed.****Proposal 4: Investigate whether the Pre-MG could co-exist with a legacy MG or not.** **Proposal 5: If the Pre-MG is allowed to co-exist with a legacy MG (under the multiple concurrent MG item), then we suggest that NW can configure the pre-configured MG and legacy MG independently and no transform between Pre-MG and legacy MG. (option 3)** **Proposal 6: If the Pre-MG is the only type of MG configured (either per FR MG or per UE MG), then the necessity of the transform between Pre-MG and MG through network needs further investigation.** **Proposal 7: The pre-configured MG should be the same as RRC configured MG after it is activated.****Proposal 8: For Pre-MG activation/deactivation criteria, option 1 could be used by the network to configure the activation/deactivation status of the Pre-MG for a particular BWP. After the configuration, it is no need to define criteria for activation/deactivation, i.e., option 3 can be used here****Proposal 9: Regarding how pre-configured MGs is activated/deactivated, for a particular BWP, the Pre-MG activation/deactivation status has already been defined by the Pre-MG configuration. After a BWP switch, the activation/deactivation status of Pre-MG should follow the configured activation/deactivation status of that BWP being switched to. Suggest to use option 2 as a baseline.** |
| [**R4-2114427**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2114427.zip) | Qualcomm CDMA Technologies | Observation1: Explicit activation and implicit activation have different implications on the UE and/or NW babviours which, consequently impacts the complexity of requirement and RAN4 work load.Observation2: In the legacy releases, there are established mechniasms such as the use of BWP-id to establish the association of a BWP with a resource.**Proposal1: Support per BWP based flag can be employed for indicating whether a pre-configured MG is associated or enabled for a BWP.****Proposal1.1: Recommend using BWP-id as the per BWP based flag in the pre-configured MG configuration or up to RAN2 design.**Observation3: Provision of explicit association of a BWP with the preconfigured MG via the RRC allows UE to pre-determine the occurrence of pre-configured MG instance with minimal processing during the time critical BWP switch timeline.Observation4: full control of the pre-configured MG by the network also requires per BWP based MG association.Observation5: With the RRC based flags for establishing the BWP and pre-configured MG association, it is possible to avoid the separate activation/deactivation procedures and RAN4 effort can be substasntially saved.**Proposal2: Support skipping the discussion on defining the (de)activation criteria in the spec since RRC flags are provided to indicate the per-BWP association with pre-configured MG.****Proposal3: Support the pre-configured MG activation/deactivation is triggered by the BWP switch and pre-configured under the control by the NW via its RRC configuration message.** |
| [**R4-2113208**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2113208.zip) | ZTE Corporation | **Observation 1: How to deal with the relation of pre-configured MG with current legacy MG, which can be de-prioritized by other important issues.** **Proposal 1: It’s unnecessary to include PRS and CSI-RS L3 measurements for pre-configured MG.****Proposal 2: When pre-configured MG being configured, the NW should indicate such MG is legacy MG or pre-configured MG, not need to indicate other parameter.****Proposal 3: It is reasonable that Whether pre-configured MG activated or not depends on whether reference signal to measure is within the active BWP or not.****Proposal 4: Option 2 can be a starting point, but whether and how to transform an legacy MG into pre-configured MG should be further studied.****Proposal 5: The existing gap pattern #0~23 in Rel 16 can be reused for pre-configured MG.** |
| [**R4-2113278**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2113278.zip) | OPPO | Proposal 1: Pre-configured MG shall be also allowed to be configured for CSI-RS L3 measurement.Proposal 2: Pre-configured MG for PRS measurement should be hold until RAN4 scope of R17 positioning WID has been decided.Proposal 3: The parameters used to indicate the pre-configured MG (de)activation status per BWP, which can differentiate with the legacy MGObservation 1: MG pattern can be changed after BWP switching, if per-configured MG is considered as part of multiple concurrent gaps.Observation 2: UE can know pre-configured MG’s activation status by either signalling or pre-defined rules.Proposal 4: The pre-configured MG can be transformed as legacy MG by network, and it acts as legacy Mg after it is active.Observation 3: UE behavior should be that:* the UE needs gaps to measure SSBs when the measured SSB is not fully within the BW of the active BWP. Otherwise, the UE can measure the SSBs without gaps.
* This change between gap based and gapless measurement is triggered by active BWP switching.

Observation 4: About Criteria of activation/deactivation pre-configured MG, wait for the conclusion of whether to introduce NW indication for pre-configured MG configuration.Proposal 5: The pre-configured MG activation/deactivation can be autonomously/implicitly triggered by the BWP switch, and also depend on the indication by the NW if introduced.Proposal 6: No additional delay beside the BWP switching delay is needed for the pre-configured MG activation/deactivation delay.Proposal 7: UE behavior should be clarified after deactivation of pre-configured MG and switching to a new BWP without any per-configured gap. Proposal 8: For UE behavior after deactivation of pre-configured MG, * Option 1: UE shall perform measurement without gap.
* Option 2: UE shall perform measurement with legacy gaps.
* Option 3: UE shall perform measurement with a default gap through immediate activation.
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| [**R4-2114063**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2114063.zip) | Nokia, Nokia Shanghai Bell | 1. In NR Rel-15, RRC signalling for configuring and activating measurement gaps has been used due to signalling robustness.
2. Errors in measurement gap configuration can have significant negative UE and system impact.
3. It is important that changes in the measurement gaps are signalled in a robust way.
4. DCI formats 0-1, 0-2, 1-1 and 1-2 need to be investigated for inclusion of information bits related to (de-)activation of pre-configured MGs and for associated signalling robustness.
5. a) The use case scenarios for pre-configured MGP include measuring intra-/inter-frequency SSB as well as measuring PRS and CSI-RS L3.

b) Pre-configured MGP also apply to inter-RAT measurements. 1. The procedures for configuration and (de-)activation of pre-configured MG patterns are designed such to support both single MGP and multiple concurrent MGPs.
2. Existing RRC signalling message (i.e. RRC reconfiguration command) shall be extended to configure a single pre-configured MGP, or, multiple pre-configured MGPs per BWP, used for per-UE or per-FR gap support.
3. Pre-configured MG(s), are configurable per-UE and per-FR, and, in case of multiple pre-configured MGPs, can additionally be configured per BWP.
4. When pre-configured MG patterns are configured via RRC signalling, they are not activated at the same time of configuration, hence remain inactive.
5. Signalling for activation / deactivation of a pre-configured MG pattern is based on explicit activation/deactivation command.
6. RAN4 to consider the robustness of the mechanisms for activation and deactivation of MG pattern when they do not use RRC signalling.
7. RAN4 need to account for robustness of the measurement gap changes when evaluating and agreeing on explicit activation/deactivation of MG pattern(s) without using RRC signalling.
8. MGP change delay shall be evaluated based on realistic latencies.
9. No additional separate delay is needed for activating a preconfigured MGP.
10. No separate additional delay is needed for deactivating a preconfigured MGP.
11. Robustness shall be evaluated including the final signal loss probability.
12. Analyse and evaluate, under realistic assumption, the possible impact on ongoing cell detection from a change in MGP.
13. Analyse and evaluate, under realistic assumption, the possible impact on the latency of ongoing measurements from a change in MGP.
14. RAN 4 to define procedures for pre-configured MG pattern support, which provide flexibility and full network control related to MG pattern usage.
15. Consider sharing of MG patterns using a MG pattern pool for specifying the configuration of pre-defined MG patterns.
16. RAN4 to consider MG patterns #0-#25 for use as pre-configured MG pattern.
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| [**R4-2114305**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2114305.zip) | Huawei, HiSilicon | **Proposal 1: RAN4 does not define any restriction on use of pre-MG for PRS or CSI-RS measurement.** **Proposal 2: Inform RAN2 that UE should always indicate serving cell about the PRS measurement when it is configured with pre-MG.** **Proposal 3: The RRC configuration of pre-MG should include the indication to differentiate with the legacy MG.****Proposal 4: There is no need to include the status (activated/deactivated) of pre-MG in the RRC configuration of pre-MG.****Proposal 5: After RRC configuration of pre-MG, UE determines the status (activated/deactivated) of pre-MG in the same way as it does following a BWP switch.** **Proposal 6: It is up to NW to transform a pre-MG into legacy MG or vice versa with same MG configuration.** **Proposal 7: Adopt the following criteria for activation and deactivation of pre-MG:*** **If MG is not required by any of the configured measurements, the MG is deactivated.**
* **If MG is required by one or more of the configured measurements, the MG is activated.**

**Proposal 8: Besides BWP switch, the following procedures are considered as trigger for activation and deactivation of pre-MG: RRC (re)configuration of MO, RRC (re)configuration of serving cells, and SCell activation and deactivation.****Proposal 9: Pre-MG is implicitly activated and deactivated when the triggering event occurs.****Proposal 10: The delay of activation and deactivation of pre-MG is defined as BWP switching delay plus *Delta*.** **The value of *Delta* can be FFS.****Proposal 11: Activation and deactivation of pre-MG takes effect from the first MG occasion after the activation and deactivation delay.****Proposal 12: The transition requirements defined in clause 9.1.6 apply also with pre-configured MG.****Proposal 13: UE behaviour after deactivation of pre-MG is same as** **that when a legacy MG is de-configured.****Proposal 14: Wait for RAN1 conclusion about MG-less PRS measurement before deciding whether to include MGP #24 and #25 for pre-MG.** |
| [**R4-2114445**](file:///C%3A%5CUsers%5Crhuang5%5COneDrive%20-%20Intel%20Corporation%5CDocuments%5Cmy_work%5CLTE_A%5CRAN4%5C100e%5CDocs%5CR4-2114445.zip) | Ericsson | **Measurement scenarios for P-MG:*** **Observation # 1**: PRS measurements are always done in measurement gaps.
* **Proposal # 1**: Pre-MG is not configured for PRS based measurements.
* **Proposal # 2**: Mechanism for pre-MG falling back to legacy MG when gNB is requested to configure MG for PRS based measurements.
* **Proposal # 3**: If Pre-MG is not supported for CSI-RS based L3 measurements then there should be a mechanism for pre-MG falling back to legacy MG when CSI-RS based measurements are configured.

**P-MG configuration procedure:** * **Observation # 2**: UE needs to differentiate Pre-MG with the legacy MG at RRC configuration or when Pre-MG is transformed into legacy MG or vice versa.
* **Observation # 3**: As agreed in the 1st stage of the WI, Pre-MG will be defined per UE and for single carrier operation.
* **Proposal # 4**: Examples of parameters which can be used to differentiate with the legacy MG are:
	+ Indicator for transforming Pre-MG into legacy MG or vice versa.
	+ Indicator for indicating the Pre-MG status (activation/deactivation) per UE at RRC configuration.

**P-MG status upon and after RRC configuration:*** **Observation # 4**: As per agreement, Pre-MG status is not fixed at RRC configuration and therefore UE behaviour needs to be defined.
* **Proposal # 5**: Prefer option 5a but can support also option 5b below if rules are well defined for enabling UE to know the Pre-MG status at RRC configuration:
	+ **Option 5a**: Signaling based: Network signals Pre-MG status (activated or deactivated) when pre-configured MG is configured or
	+ **Option 5b**: Rule based: Pre-MG status (activated or deactivate) depends on whether reference signal to measure is within the active BWP or not.
* **Observation # 5**: Several measurement scenarios need legacy MG and can be requested/configured while the UE is configured with Pre-MG e.g.
	+ PRS based measurements
	+ Inter-frequency measurements unless UE is capable of measurements without gaps
	+ Inter-RAT measurements
* **Observation # 6**: Deconfiguration of Pre-MG and configuration of legacy MG (e.g. when PRS or inter-RAT carrier is measured/configured) will lead to more overheads, longer delay and may require UE to restart ongoing measurements or increase the measurement delay.
* **Proposal # 6**: Support a mechanism to allow the UE to transform Pre-MG into legacy MG or vice versa.
* **Proposal # 7**: The main aspects of the transformation mechanism in proposal 6 are:
	+ The already configured Pre-MG is transformed into legacy MGP (with same MGL/MGRP) if the UE is configured to measure on any carrier (e.g. inter-RAT) which always need gaps for performing the measurement.
	+ Network can transform an already configured Pre-MG into legacy MGP with same MGL/MGRP or vice versa without deconfiguring the Pre-MG
	+ Deconfigure Pre-MG and reconfigure legacy pattern if Pre-MG is not suitable for MO configuration e.g. inter-RAT, PRS etc.
	+ Network can transform a Pre-MG into legacy MG or vice versa with same MG configuration.
* **Proposal # 8**: The transformation between Pre-MG and legacy MGP is controlled by the network e.g. 1-bit indicator.

**P-MG activation/deactivation procedure:*** **Observation # 7**: The UE needs gaps to measure SSBs when the measured SSB is not fully within the BW of the active BWP. Otherwise the UE can measure the SSBs without gaps. This change between gap based and gapless measurement is triggered by active BWP switching.
* **Observation # 8**: In the 1st phase the Pre-MG based measurement scenario is supported for single carrier operation:
	+ RRC reconfiguration of serving cells or SCell activation/deactivation will NOT occur while Pre-MG is being configured.
* **Observation # 9**: The RRC (re)configuration of MO is long term procedure and is more relevant to transforming the Pre-MG to legacy MG or vice versa depending on whether the MO needs legacy MG or not.
* **Proposal # 9**: Pre-MG is autonomously/implicitly triggered by DCI/Timer based BWP switching.
* **Proposal # 10**: Impact of CA/DC related procedures (e.g. RRC reconfiguration of serving cells, SCell activation/deactivation etc) on Pre-MG status is not considered in the 1st phase of the WI.
* **Proposal # 11**: The impact of RRC (re)configuration of MO on Pre-MG is addressed by means of transformation mechanism to transform between Pre-MG and legacy MG e.g. depending on if the MO needs legacy MG or not.

**RRM requirements: transition time due to Pre-MG status (activation/deactivation) change:*** **Observation # 10**: Transition time for switching between gap-based measurement (activated state) and gapless measurement (deactivated state) is needed by the UE to adapt to the new measurement procedure after the active BWP switching e.g. since measurement sampling may be different in the two procedures
* **Observation # 11**: Transition time for switching between gap-based measurement (activated state) and gapless measurement (deactivated state) is needed the gNB to adapt to scheduling after the active BWP switching e.g. complete on going scheduling in gaps or start scheduling in gaps.
* **Observation # 12**: The transition time becomes even more critical when BWP switching occurs shortly before the occurrence of the gap e.g. for shorter MGRP.
* **Proposal # 12**: The transition time (ΔT) to account for the change in the Pre-MG status (activated/deactivated) is specifiied.
* **Proposal # 13**: The UE shall change Pre-MG status at time instance, T0+ΔT, where:
	+ T0 is the instance when change in the Pre-MG status is triggered e.g. when BWP switching occurs.
	+ ΔT = TBWP switch + Tmargin.
	+ TBWP switch is the BWP switching delay.
* Tmargin = [20 ms] is a margin.
* **RRM requirements: measurement period:**
* **Observation # 13**: The delay requirements in section 9.1.6, TS 38.133 for transitions from measurements performed outside gaps to measurements performed within gaps or vice versa does not account for any time to configure the measurement gaps e.g. when switching from gapless to gap-based measurement.
* **Observation # 14**: The requirements in section 9.1.6, TS 38.133 apply when the UE is already configured with gaps for certain measurement but after the BWP switching the UE starts using the same gaps also for measurement which was being performed without gaps before the BWP switching.
* **Proposal # 14**: The total measurement period (Tmeasure, total) to account for transition time (ΔT) between activation and deactivation of the Pre-MG during the measurement needs to be specified.
* **Proposal # 15**: Total measurement period (Tmeasure, total) can be expressed in terms of basic measurement period (Tmeasure, basic) and aggregated time consumed due to total number of transitions (N\*ΔT) between gapless measurement procedure and gap-based measurement procedure during the ongoing measurement:
* Tmeasure, total = Tmeasure, basic+ N\*ΔT; where
* N=total number of transitions in the measurement period
* **Proposal # 16**: In proposal 15, Tmeasure, basic can be expressed as: Tmeasure, basic = MAX(Tmeasure,BWP, Tmeasure,MG); where:
	+ Tmeasure,BWP=It is measurement period when the measurement is fully performed without measurement gap

Tmeasure,MG =It is measurement period when the measurement is fully performed with measurement gap.**RRM requirements: UE behavior after deactivation:*** **Proposal # 17:** After Pre-MG is deactivated the UE shall measure without causing any interruption and shall be able to receive and transmit in the serving cell in all the slots even within MGL of Pre-MG.

**Gap patterns for Pre-MG:*** **Observation # 15**: The current MGP # 24 and # 25 are used when the UE is configured with positioning measurements, which always need gaps.
* **Proposal # 18**: The existing gap patterns (0~23) in Rel-16 can be reused for the Pre-MG.
 |

## Open issues summary and companies views’ collection for 1st round

### Sub-topic 0 Definition and using scenarios for Pre-configured measurement gap

#### **Issue#0-1 Whether can the pre-MG be used for PRS measurement?**

* Option 1 (CATT, Intel, Apple, MTK, CMCC, vivo, Nokia, Huawei). Yes
	+ Option 1a (Intel, Apple) Yes. But NW can prioritize the legacy MG configuration in comparison with Pre-MG
	+ Option 1b (MTK, CMCC, Ericsson): Yes with the following side conditions:
		- Pre-MG is always on
	+ Option 1c (Huawei): Yes with the following side conditions:
		- UE should always indicate serving cell about the PRS measurement when it is configured with pre-MG.
* Option 2(ZTE, Ericsson, xiaomi). No
* Option 3 (vivo, Ericsson). Pre-configured MG falls back to the legacy MG
* Option 4(OPPO). FFS up to RAN4 scope of R17 positioning WID

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#### **Issue#0-2 Whether can the pre-MG be used for CSI-RS L3 measurement?**

* Option 1 ( CATT, Intel, Nokia, Huawei, Ericsson, xiaomi). Yes
* Option 1a (MTK, CMCC, Ericsson): Yes with the following side conditions:
	+ Pre-MG is always on
* Option 2 (Apple, ZTE). No
* Option 2a (Ericsson): If Pre-MG is not supported for CSI-RS based L3 measurements then there should be a mechanism for pre-MG falling back to legacy MG when CSI-RS based measurements are configured

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### Sub-topic 1 Pre-MG configuration

#### **Issue 1-1 Specific RRC configuration parameters for the new aspects of Pre-MG to be introduced**

**[***Moderator Notes: In the last meeting, the basic procedures to use the preconfigured MG for UE measurement was agreed as:*

* + FFS on the specific configuration parameters for the new aspects of pre-configured MG to be introduced,
		- **Option1**: The parameters used to differentiate with the legacy MG
		- **Option 2a**: The parameters used to indicate the pre-configured MG (de)activation status per BWP, which can be also served as the flag to differentiate with the legacy MG
		- **Option 2b:** The parameters used to indicate the pre-configured MG (de)activation status per UE/FR, which can be also served as the flag to differentiate with the legacy MG
	+ Pre-configured MG status (activated/deactivated) after configuration completed
		- Status of pre-configured MG is not fixed at RRC configuration
		- NW can know the pre-configured status when/after the pre-MG being configured by itself
		- FFS NW can fully control whether the pre-configured MG will be activated/deactivated
		- FFS on how UE can know pre-configured MG’s activation status (activated/deactivated) after the pre-MG being configured
			* Option 1: signaling
			* Option 2: pre-defined rules

*Therefore, for Pre-MG configuration, couples of necessary parameters below can be FFS in this meeting.*

* *Parameter to differentiate the legacy MG and Pre-MG*
* *Parameter to indicate the status (activation/deactivation) of Pre-MG after being configurated*

*Companies can provide your views on this question. And multiple parameters can be needed.]*

#### **Issue 1-1-1: Parameter to differentiate the legacy MG and Pre-MG**

* Option1(MTK, ZTE, Huawei, Ericsson): Yes. The parameters used to differentiate pre-MG with the legacy MG
* Option 2a(Apple, Intel, vivo, Qualcomm, OPPO, xiaomi): No. The parameters used to indicate the pre-configured MG (de)activation status per BWP, which can be also served as the flag to differentiate with the legacy MG
* Option 2b(CATT) : No. The parameters used to indicate the pre-configured MG (de)activation status per UE/FR, which can be also served as the flag to differentiate with the legacy MG

Recommended WF: Further discussion needed. Collect companies’ views.

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#### **Issue 1-1-2 Parameter to indicate the status (activation/deactivation) of Pre-MG after being configurated**

* Option 1 (CATT, xiaomi, Intel, Apple, vivo, Qualcomm , Ericsson): RRC signaling
* Option 2 (CMCC, ZTE, Huawei, Ericsson): No signaling needed. UE can know autonomously with pre-defined rules
	+ Option 2a(Nokia) : Pre-MG remained inactive after being configurated

Recommended WF: Further discussion needed. Collect companies’ views.

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#### **Issue 1-2: Whether can NW fully control the pre-MG status (e.g. activated/deactivated) after being configured?**

* Option 1 (CATT, Apple, vivo, Ericsson, Nokia) : Yes

Recommended WF: Further discussion needed. Collect companies’ views.

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#### **Issue 1-3 Relation of pre-configured MG and with the current legacy MG**

**[***Moderator Notes: In the last meeting, the basic procedures to use the preconfigured MG for UE measurement was agreed as:*

* + FFS on relation of pre-configured MG pattern and with the current RRC configured MG
		- Option 1. (CATT, xiaomi):
			* The pre-configured MG is the same as RRC configured MG after it is activated.
			* Whether the deactivated pre-configured MG and the RRC configured MG can be configured simultaneously needs to be studied
		- Option 2a (Ericsson, ZTE)
			* The already configured P-MGP is transformed into legacy MGP (with same MGL/MGRP) if the UE is configured to measure on any carrier (e.g. inter-RAT) which always need gaps for performing the measurement.
			* Network can transform an already configured P-MGP into legacy MGP with same MGL/MGRP or vice versa without deconfiguring the P-MGP
			* Deconfigure P-MG and reconfigure legacy pattern if P-MG is not suitable for MO configuration e.g. inter-RAT, PRS etc.
		- Option 2b (Huawei, MTK, vivo, Apple, Ericsson):
			* Network can transform a pre-configured MG into legacy MG or vice versa with same MG configuration.
		- Option 3 (Intel, Qualcomm, Nokia)
			* NW can configure the pre-configured MG and legacy MG independently. The transformation between the pre-MG and legacy MG has not any benefits in both singnaling and latency reduction.

*]*

* Option 1a (CATT, MTK,OPPO, Huawei):
	+ NW can transform a Pre-MG into legacy MG or vice versa with same MG configuration
* Option 1b (Ericsson, ZTE)
	+ NW can transform a Pre-MG into legacy MG or vice versa if
		- The already configured P-MGP is transformed into legacy MGP (with same MGL/MGRP) if the UE is configured to measure on any carrier (e.g. inter-RAT) which always need gaps for performing the measurement.
		- Network can transform an already configured P-MGP into legacy MGP with same MGL/MGRP or vice versa without deconfiguring the P-MGP
		- Deconfigure P-MG and reconfigure legacy pattern if P-MG is not suitable for MO configuration e.g. inter-RAT, PRS etc.
* Option 2 (Intel, xiaomi, vivo)
	+ NW can configure them independently.
* Option 2a (Apple)
	+ NW can configure them independently. **Network can transform a pre-configured MG into legacy MG or vice versa with same MG configuration**

Recommended WF: Further discussion needed. Collect companies’ views.

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

#### **Issue 2-1 Criteria of activation/deactivation pre-configured MG**

[*Moderator notes: the agreements in the last meeting are:*

* ***Criteria of activation/deactivation pre-configured MG***
	+ *Option 1 (Huawei, MTK, vivo, ZTE) :*
		- *If MG is not required by any of the configured measurements, the MG is deactivated.*
		- *If MG is required by one or more of the configured measurements, the MG is activated.*
	+ *Option 2 (Ericsson, vivo, OPPO, ZTE):*
		- *The UE needs gaps to measure SSBs when the measured SSB is not fully within the BW of the active BWP. Otherwise, the UE can measure the SSBs without gaps. This change between gap based and gapless measurement is triggered by active BWP switching.*
	+ *Option 3(Intel, Apple, Qualcomm, Nokia, Xiaomi): No need to define such criteria in the spec if the NW indication was included in pre-configured MG configuration.*

]

* Option 1a (MTK): Define Pre-MG activation/deactivation criteria as:
	+ MO’s needs on the gap for the measurements(inter-f, inter-RAT, intra-f with gap) changed because of any operations below
		- BWP switching
		- adding/removing any measurement object(s),
		- adding/releasing/changing a PSCell,
		- activating/de-activating any SCell(s)
* Option 1b (Huawei): Define Pre-MG activation/deactivation criteria as:
	+ If MG is not required by any of the configured measurements, the MG is deactivated.
	+ If MG is required by one or more of the configured measurements, the MG is activated.
* Option 1c (Ericsson): Define Pre-MG activation/deactivation criteria as
	+ The UE needs gaps to measure SSBs when the measured SSB is not fully within the BW of the active BWP. Otherwise, the UE can measure the SSBs without gaps. This change between gap based and gapless measurement is triggered by active BWP switching
* Option 2(vivo): Define the criteria for the network ONLY when it configure the activation/deactivation status of the Pre-MG for a particular BWP.
* Option 3(CATT, Intel, Xiaomi, Qualcomm) : No need to define such criteria in the spec if the NW indication was included in pre-configured MG configuration.
* Option 4(OPPO): FFS upon the conclusion of whether to introduce NW indication for pre-configured MG configuration

Recommended WF: Further discussion needed. Collect companies’ views.

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#### **Issue 2-2 How pre-configured MGs can be activated/deactivated**

* Option 1a (Ericsson, xiaomi, CMCC) Autonomously/implicitly triggered by BWP switching DCI/Timer.
* Option 1b(MTK) Autonomously/implicitly triggered by finishing the following network commands and procedures: BWP switching, adding/removing any measurement object(s), adding/releasing/changing a PSCell, activating/de-activating any SCell(s).
* Option 1c (Huawei) Autonomously/implicitly triggered by
	+ BWP switching or
	+ other RRC procedures that could trigger a change in need for MG, e.g.
		- RRC (re)configuration of MO
		- RRC (re)configuration of serving cells
		- SCell activation and deactivation
* Option 2a (Intel, Qualcomm, vivo, OPPO) the pre-configured MG activation/deactivation is triggered by the BWP switch and under the control by the NW via its RRC configuration message.
* Option 2b (CATT, Nokia) the pre-configured MG activation/deactivation is triggered by the BWP switch and under the control of the DCI for triggering BWP switch or new DCI/MAC CE/RRC after BWP switch

Recommended WF: Further discussion needed. Collect companies’ views.

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### Sub-topic 3 RRM requirements

#### **Issue 3-1 Activation/Deactivation Delay**

[*Moderator notes: the agreements in the last meeting are:*

* ***FFS on additional transition time for pre-configure MG (de)activation can be taken count into the total pre-configured MG activation/deactivation delay beside the BWP switching delay.***
	+ ***If agreed the exact value of such transition time can be FFS.***

*Therefore, in this meeting, we can discuss the issue below*

*“FFS on additional transition time for pre-configure MG (de)activation can be taken count into the total pre-configured MG activation/deactivation delay beside the BWP switching delay. “*

]

* Option 1(CATT, OPPO, Nokia): **No additional transition time is needed for the pre-configured MG activation/deactivation.**
* Option 1a(Intel): RAN4 needs NOT to define the separated activation delay requirements for the pre-configured MG activation unless the BWP switching time is shorter than “gap transition time”.
* Option 2 (MTK, Apple, Huawei, Ericsson, Xiaomi): Additional transition time (ΔT) **beside the BWP switching delay** shall be included in the pre-configured MG activation/deactivation time on top of the BWP switching delay..
	+ Option 2a (MTK, Huawei): ΔT = TBD
	+ Option 2b(Apple):ΔT=3~5ms
	+ Option 2c(Ericsson):ΔT=[20ms]
	+ Option 2d(Huawei): Activation and deactivation of pre-MG takes effect from the first MG occasion after the activation and deactivation delay.
	+ Option 2e (Xiaomi):the total delay requirement for pre-configured MG activation/deactivation should be the DCI/timer based BWP switching delay plus the additional transition time between activation and deactivation of pre-configured MG.

Recommended WF: Further discussion needed. Collect companies’ views.

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#### **Issue 3-2 Measurement period**

[*Moderator notes: The general principle to define the measurement period with Pre-MG are summarized as below. Multiple of items can be proposed.]*

* Option 1 (MTK):
	+ UE re-starts a new measurement period once the pre-MG status changes. It is up to UE whether to reuse any measurement samples prior to activation/de-activation of the pre-MG to trigger a measurement event.
* Option 2 (Apple) :
	+ if MG happens less than the additional transition time mentioned above after BWP switching, UE is allowed to drop the measurement opportunity and longer measurement latency can be expected**.**
* Option 3 (CATT): If BWP switch occurs and the pre-configured MG is activated or deactivated during the measurement period, it is preferred to define requirements based on the number of resources within gap and without gap respectively
* Option 3 (Huawei):The transition requirements defined in clause 9.1.6 apply also with pre-configured MG.
* Option 4. (Ericsson):
	+ The total measurement period Tmeasure, total) to account for transition between activated and deactivated P-MGP during the measurement needs to be specified
	+ Total measurement period (Tmeasure, total) can be expressed in terms of basic measurement period (Tmeasure, basic) and aggregated time consumed due to total number of transitions between gapless measurement procedure and gap-based measurement procedure during the ongoing measurement.
	+ Tmeasure, basic can be expressed as: Tmeasure, basic = MAX(TBWP, TG); where:
		- TBWP= It is the measurement period when the measurement is fully performed without measurement gap
		- TG= It is the measurement period when the measurement is fully performed with measurement gap~~.~~
* Option 5(Nokia): Analyse and evaluate, under realistic assumption, the possible impact on the latency of ongoing measurements from a change in MGP.
* Option 6 (Xiaomi): If there is one or more transitions between gap-based and gapless measurement during one measurement period, the relaxed measurement requirement shall be applied.

Recommended WF: Further discussion needed. Collect companies’ views.

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#### **Issue 3-3 UE behavior after deactivation of pre-configured MG**

* Option 1 (OPPO): After deactivation of pre-configured MG and switching to a new BWP without any per-configured gap,
	+ option 1: UE shall perform measurement without gap until switching away from this BWP.
	+ option 2: Immediate activation of default gap. UE shall perform measurement with default gap.
	+ option 3: UE shall perform measurement with legacy per UE or per FR gaps.
* Option 2 (Ericsson)
	+ After P-MG is deactivated the UE shall measure without causing any interruption and shall be able to receive and transmit in the serving cell in all the slots even within MGL of P-MG.
* Option 3(Huawei): UE behaviour after deactivation of pre-MG is same as that when a legacy MG is de-configured
* Option 4(CATT): UE shall perform measurement without MG and be able to receive and transmit in the serving cell.

Recommended WF: Further discussion needed. Collect companies’ views.

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### Sub-topic 4 MG pattern configurations

#### **Issue 4-1 MG patterns used for the pre-configured MG mechanism**

* Option 1. (MTK,xiaomi, OPPO, Ericsson, ZTE): The existing gap patterns (0~23) in Rel16 can be reused for the pre-configured MG
* Option 2. ( CATT, Intel, Nokia): All existing MG patterns #0~25 in Rel-16 are applicable for the pre-configured MG
* Option 3 (Huawei): FFS upon on RAN1’s conclusion on MG-less PRS measurement in Rel17

Recommended WF: Further discussion needed. Collect companies’ views.

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## CRs/TPs comments collection

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## Summary for 1st round

### Open issues

## Discussion on 2nd round

Please only comment on topics that are selected for discussion in 2nd round.

## Summary on 2nd round

No further agreement was reached in the 2nd round.

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
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# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on R17 NR MG enhancements – Pre-configured MG | Intel |  |
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**Existing tdocs**

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

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| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
|  | WF on R17 NR MG enhancements – Pre-configured MG |  |  |  |
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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