3GPP TSG-RAN WG4 Meeting #111 R4-2408025

Fukuoka City, Fukuoka , Japan, 20th – 24th May, 2024

**Agenda item:** 10.6.3

**Source:** Moderator (Apple)

**Title:** Topic summary for [111][228] NR\_RRM\_Ph5

**Document for:** Information

# Introduction

This topic summary includes General aspects (work plan) (10.6.1) and FR2-1 SSB based L3 measurement delay reduction for connected mode (10.6.2).

*List of candidate target of discussions for this topic.*

* Mainly discuss on
  + Issue 2-1-1, 2-1-2, 2-1-3, 2-2-1, 2-2-2, 2-2-3, 2-3-1.
  + Then other issues.

# Topic #1: General aspects (work plan) (10.6.1)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2408529**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408529.zip) | Ericsson | Workplan for RRM enhancement phase 5 fast Scell activation |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

**Issue 1-1: Work plan for NR\_RRM\_Ph5 WI**

* Option 1 (Ericsson): Workplan for RRM enhancement phase 5 fast SCell activation in R4-2408529.
* Recommended WF:
  + No discussion.The fast SCell activation work plan has been agreed in R4-2404368 in last meeting.

# Topic #2: FR2-1 SSB based L3 measurement delay reduction for connected mode (10.6.2)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2407312**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407312.zip) | Apple | Proposal 1: L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable to PCell, PSCell, or SCell, provided the cell is the only serving cell in the single FR2-1 band and UE is configured with one FR2-1 band.  Proposal 2: RAN4 to consider UE supporting FR2-1 power class 3 as first priority.  Proposal 3: the conditions for UE to apply L3 measurement delay reduction by optimizing Rx BSF are as followings:   * multi-Rx simultaneous reception of UE is in active mode, which is expected to follow the one specified in Rel-18 for multi-Rx simultaneous reception features * Low mobility scenario (e.g., not consider HST) * the legacy searcher assumption and legacy CSSF shall still be applied for L3 RRM measurement with two panels activated * considering power consumption, BSF reduction of L3 measurement will not trigger UE to activate multi-Rx.   Proposal 4: Prioritize following scenarios as starting points to use L3 measurement delay reduction by optimizing Rx BSF:   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Intra-frequency measurement with MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * SSB based Inter-frequency measurement with MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter   Proposal 5: After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios, the solutions(s) can be extended to other scenarios, e.g., handover, PSCell addition, RRC Re-establishment/RRC Connection Release with Redirection, SCell activation, SCG activation, CGI reading, and the associated SSB synchronization in CSI-RS L3 measurement.  Proposal 6: For UE supporting multiple-Rx simultaneous reception, it is proposed to reduce L3 measurement delay by reducing Rx BSF, and Rel-18 Rx BSF reduction in L1 measurement can be used as baseline.  Proposal 7: RAN4 is not to change existing measurement performance requirement when consider optimization of Rx BSF in L3 measurement delay reduction. The accuracy test requirement for Rx BSF optimization in L3 measurement delay reduction can be FFS.  Proposal 8: RAN4 to introduce a new individual capability for L3 BSF reduction due to multi-Rx operation in R19. But also fine to delay the capability discussion to the end of the core part.  Proposal 9: Rel-19 CSSF optimization applies for the both cases: (1)UE is not capable of Rel-18 multi-Rx simultaneous reception, (2)UE is capable of Rel-18 multi-Rx simultaneous reception but work in single-Rx currently.  Proposal 10: the following scenarios to use L3 measurement delay reduction by optimizing CSSF shall be prioritized:   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter and TSSB\_measurement\_period\_inter   Proposal 11: RAN4 only consider the enhancement based on 2 searchers, i.e., same as previous release, for L3 measurement delay reduction by optimizing CSSF.  Proposal 12: RAN4 to consider EN-DC, NE-DC, SA and NR-DC for L3 measurement delay reduction by optimizing CSSFoutside\_gap,i .  Proposal 13: Solutions to apply/specify L3 measurement delay reduction by optimizing CSSF outside gap in CA/DC:   * Enhancement option 1: UE only needs to measure one serving carrier per band if multiple serving carriers are in the same band,   + If PCC in the band, measure PCC   + Otherwise if PSCC in the band, measure PSCC   + Otherwise if SCC is in the band, measure the SCC with neighbor cell MO   + Otherwise up to UE implementation * Enhancement option 2: UE can reduce the searcher occupancy ratio of PCC or PSCC measurement to speed up SCC measurement for certain conditions   + The conditions can be FFS.   Proposal 14: RAN4 is not to change existing measurement performance requirement when consider optimization of CSSF in L3 measurement delay reduction.  Proposal 15: RAN4 to introduce a new individual capability for CSSF reduction in R19. But also fine to delay the capability discussion to the end of the core part.  Proposal 16:   * for “FR2-1 SSB based L3 measurement delay reduction for connected mode” by optimizing Rx beam sweeping factor, R18 feature of FR2 multi-Rx reception shall be considered * for “FR2-1 SSB based L3 measurement delay reduction for connected mode” by optimizing CSSF outside gap, both R16 inter-frequency measurement without MG and R18 inter-RAT measurement without MG shall be considered. |
| [**R4-2407375**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407375.zip) | NTT DOCOMO, INC. | Proposal 1: The number of configured MOs has not to be one if these MOs are intra-frequency layer.  Proposal 2: The applicable scenario should be modified as follows,   * L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided the target frequency layer to be measured belongs to the same ~~is the only one in the single~~ FR2-1 band and UE is configured ~~[~~with one FR2-1 band~~]~~. * RAN4 to consider UE supporting FR2-1 power class 3 as first priority.   Proposal 3: At least following scenarios can be candidates to use L3 measurement delay reduction by optimizing Rx BSF:   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Intra-frequency measurement with MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * SSB based Inter-frequency measurement with MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * Handover * PSCell addition * RRC Re-establishment/RRC Connection Release with Redirection * CGI identification |
| [**R4-2407521**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407521.zip) | CATT | Proposal 1: For enhanced BSF to reduce L3 measurement delay, it is proposed to reuse the condition and definition in Rel-18 Multi-Rx as much as possible.  Proposal 2: For enhanced BSF to reduce L3 measurement delay, on top of the UE capability of supporting Multi-Rx, no additional conditions of prior knowledge for target cell is needed so far.  Proposal 3: The enhanced BSF can also be used for HST if no technical issues identified.  Proposal 4: It is proposed not to restrict the number of configured carriers and applied power class.  Proposal 5: Taking intra-/inter-frequency measurement and handover requirements as baseline to discuss the L3 measurement delay reduction by optimizing Rx BSF. Other requirements can be discussed after the solutions are clear.  Proposal 6: RAN4 not to change existing measurement performance requirement when applying L3 measurement delay reduction by optimizing Rx BSF.  Proposal 7: For L3 measurement delay reduction by optimizing CSSF outside gap, all the EN-DC, NE-DC, SA and NR-DC scenarios can be considered.  Proposal 8: Taking intra-/inter-frequency measurement requirements as baseline to discuss the L3 measurement delay reduction by optimizing CSSF outside gap in CA/DC.  Proposal 9: Multiple solutions can be specified to enhance CSSF outside gap by considering both 2 searchers and 3 searchers.  Proposal 10: RAN4 not to change existing measurement performance requirement when applying L3 measurement delay reduction by optimizing CSSF outside gap in CA/DC. |
| [**R4-2407835**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407835.zip) | Xiaomi | Proposal 1: The following L3 measurement delay requirements in TS38.133 [3] can be taken as our baseline to be optimized.   |  |  | | --- | --- | | Current requirements in TS38.133 | UE operating multiple-Rx mode | | 9.2.5 Intra-frequency measurements without measurement gaps | Needs to be enhanced | | 9.2.6 Intra-frequency measurements with measurement gaps | Needs to be enhanced | | 9.3.4 Inter-frequency measurement with measurement gaps | Needs to be enhanced | | 9.3.9 Inter frequency measurements without measurement gaps | Needs to be enhanced | | 6.1.1.4 NR FR2- NR FR2 Handover | Needs to be enhanced by leveraging the conclusion from the requirements for L3 measurement defined in 9.2 and 9.3. |   Proposal 2: The SSB based L3 measurement delay reduction with DRX shall be deprioritized.  Proposal 3: UE multiple RX beams shall be used for the same cell’s measurement in order to reduce L3 measurement delay.  Proposal 4: In order to shorten the overall L3 measurements delay, the smaller RX beam sweeping factor for SSB index acquiring and SSB measurement can be used in comparison with that for PSS/SSS detection. |
| [**R4-2407872**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407872.zip) | OPPO | Proposal 1: L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided the target frequency layer to be measured is the only carrier on FR2-1 band which is the only FR2-1 band configured for UE.  Proposal 2: RAN4 to consider UE supporting FR2-1 power class 3 as first priority.  Proposal 3: RAN4 firstly to define requirements of SSB based intra-frequency and inter-frequency measurements with fast beam sweeping, and then decide whether to apply them for other procedures including L3 measurements.  Proposal 4: For deactivated SCell and PSCell in FR2-1, the enhancement of TPSS/SSS\_sync and TSSB\_measurement\_period can also apply.  Proposal 5: RAN4 to consider EN-DC, NE-DC, SA and NR-DC for optimizing CSSFoutside\_gap,i scaling factor.  Proposal 6: RAN4 to discuss the optimization of counting the number of configured SCell(s) or MOs without MG for CSSFoutside\_gap in FR2 L3 measurements.  Proposal 7: RAN4 to consider existing accuracy requirements of FR2-1 SSB based measurement as baseline. |
| [**R4-2407965**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407965.zip) | LG Electronics Inc. | - Proposal 1: L3 measurement delay enhancement in Rel-19 by optimizing Rx BSF for UE supporting multi-Rx simultaneous reception are applicable provided target frequency layer to be measured is the only single carrier for intra- / inter-frequency L3 measurement in the configured FR2-1 band but without CA configuration.  - Proposal 2: The supporting power class for L3 measurement delay enhancement with multi-Rx simultaneous reception is PC3 as first priority, but RAN4 should consider if other power classes could apply the outcome of the WI discussion.  - Proposal 3: The L3 measurement delay enhancement requirements for UE supporting multi-Rx simultaneous reception can apply if multiple panels are activate and SSBs in a SMTC window can be measured with multiple beams.  - Proposal 4: For power consumption of multi-Rx operation, Rel-18 UAI ‘multiRx-PreferenceFR2’ for power saving can be considered as starting point.  - Proposal 5: SSB based intra- / inter-frequency measurement with and without measurement gap should be considered as first priority.  - Proposal 5-1: RAN4 to discuss how to reduce M values for SSB based intra- / inter-frequency measurements for UE supporting multi-Rx simultaneous reception  - Proposal 6: RAN4 not to consider SSB based L3 measurement delay enhancement with previous release features. |
| [**R4-2408185**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408185.zip) | CMCC | Proposal 1: the conditions for UE to apply L3 measurement delay reduction by optimizing Rx BSF is that multi-Rx simultaneous reception of UE is in active mode, as for whether the condition is same as that for Rel-18 multi-Rx simultaneous reception can be further discussed.  Proposal 2: L3 measurement delay reduction by optimizing Rx BSF is applied to HST.  Proposal 3: at least following scenarios need to be considered to apply L3 measurement delay reduction by optimizing Rx BSF:   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Intra-frequency measurement with MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * SSB based Inter-frequency measurement with MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter   Proposal 4: L3 measurement delay reduction by optimizing Rx BSF is applied to handover, in detail, Tsearch could be reduced to reduce the handover interruption time.  Proposal 5: for L3 measurement delay reduction by optimizing CSSF, it is proposed to consider following scenarios:   * Intra-frequency measurement without MG, * Inter-frequency measurement without MG, * Inter-RAT measurement without MG   Proposal 6: it is proposed that FR2-1 L3 measurement delay reduction by optimizing CSSF is considered for 1st phase, and the technical solutions can be extended to FR1 when applicable.  Proposal 7: it is proposed to consider both the CSSF optimization based on 2 searchers and the CSSF optimization based on 3 searchers.  Proposal 8: For CSSF optimization, it is proposed that SA, NR-DC, NE-DC, EN-DC are considered, since legacy CSSFoutside\_gap are specified for all these scenarios. |
| [**R4-2408249**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408249.zip) | ZTE Corporation, Sanechips | Proposal 1: For the case of single FR2-1 band allowed, multi-Rx can be applicable to both L3 measurement with gap and without gap. For the case of multiple FR2-1 bands allowed, multi-Rx is only beneficial for L3 measurement with gap.  Proposal 2: When considering the number of serving cell within a band, both the impact on traffic data reception and other L3 measurement should be considered.   * From the perspective of impact on traffic data reception, multi-Rx based L3 measurement can be performed regardless single or multiple serving cells configured in a band. * From the perspective of impact on other L3 measurement, to support multi-Rx based L3 measurement, the assumption of 2 searchers can not be satisfied if multiple serving cells configured.   + To support multi-Rx based L3 measurement in multiple serving cells case, 2 searchers assumption has to be degraded into 1 searcher assumption.   Proposal 3: The applicability conditions of multi-Rx L3 measurement includes:   * Only support multi-Rx L3 measurement for CONNECTED UE * The UE is in multi-Rx operation if following condition is met: UE is configured with group-based beam reporting (GBBR) report * Preclude the HST scenario since reduced Rx beam sweeping has been introduced for HST * Simultaneous operation between L3 and L1 measurements by optimizing Rx BSF, simultaneous operation between L3 measurement and data reception by optimizing Rx BSF   Proposal 4: The multi-Rx L3 measurement can be applied for:   * SSB based Intra-frequency measurement without MG * SSB based Intra-frequency measurement with MG * SSB based Inter-frequency measurement without MG * SSB based Inter-frequency measurement with MG * Handover * PSCell addition * RRC Re-establishment/RRC Connection Release with Redirection * SCG activation * CGI identification   Proposal 5: For the CSSF enhancement, CA, EN-DC, NE-DC and NR-DC are applicable scenarios.  Proposal 6: Besides the case UE is not capable of R18 multi-Rx simultaneous reception, R19 CSSF optimization is also applied to the case that UE is capable of multi-Rx but not configured with GBBR report. |
| [**R4-2408301**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408301.zip) | vivo | Proposal 1: RAN4 to consider introduce multi-Rx UE capability of reduced Rx beam sweeping factor for FR2 L3 measurement delay reduction.  Proposal 2: The applicable scenarios are to be revised to:   * L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-Rx simultaneous reception are applicable provided the target frequency layer to be measured is the single carrier and UE is configured with one FR2-1 band. * RAN4 to consider UE supporting FR2-1 power class 3 as first priority.   Proposal 3: RAN4 to discuss the following conditions for UE to apply L3 measurement delay reduction by optimizing Rx BSF.   * + Multi-Rx simultaneous reception of UE is in active mode, which is expected to follow the one specified in Rel-18 for multi-Rx simultaneous reception features   + Low mobility status   + RRM measurement with two panels activated, two searchers are occupied by this single carrier   + SSB processing delay/time for processing multiple beams received in a SMTC   + Power consumption issue   + UE has prior knowledge on the cell to be measured   + Rel-19 L3 measurement with multi-Rx DL reception is irrelevant to multi-TRP operation deployment   + Other conditions: cell-centre UE or cell-edge UE   Proposal 4: Following aspects are out of scope:   * + - Handover     - PSCell addition     - RRC Re-establishment/RRC Connection Release with Redirection     - SCell activation     - SCG activation     - CGI identification     - CSI-RS based intra-/inter-frequency measurements, the CSI-RS is configured associatedSSB       * The discussion on CSI-RS configured with associatedSSB could be revisited if SSB based L3 measurement delay reduction is concluded.   Proposal 5: RAN4 to consider the SSB based intra and inter frequency measurement without MG as the scenarios to use L3 measurement delay reduction by optimizing CSSF. |
| [**R4-2408315**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408315.zip) | China Telecom | Proposal 1: UE shall support Rel-18 multi-Rx capability and multi-Rx simultaneous reception of UE is in active mode, which are the basic conditions to apply L3 measurement delay reduction by optimizing Rx BSF.  Proposal 2: The discussion on L3 measurement delay reduction by optimizing Rx BSF can be focused on low mobility status, and HST is precluded.  Proposal 3: It’s proposed to consider conditions of prior knowledge on the cell to be measured and discuss whether the conditions of prior knowledge are applicable.  Proposal 4: For scenarios to use L3 measurement delay reduction by optimizing Rx BSF, the L3 measurement process of SSB based Intra-frequency/Inter-frequency measurement without/with MG can be considered.  Proposal 5: For scenarios to use L3 measurement delay reduction by optimizing Rx BSF, unknown target FR2 cell delay requirements in Handover scenario can be considered.  Proposal 6: Rx beam sweeping factor methods in Rel-18 multi-Rx/ eFeRRM WI can be considered as baseline for FR2-1 SSB based L3 measurement delay reduction.  Proposal 7: RAN4 is not to change existing measurement performance requirement when consider optimization of Rx BSF in measurement delay.  Proposal 8: For scenarios to use L3 measurement delay reduction by optimizing CSSF, the L3 measurement process of SSB based Intra-frequency/Inter-frequency measurement without MG can be considered.  Proposal 9: For conditions to apply L3 measurement delay reduction by optimizing CSSF, it’s proposed only consider the enhancement based on 2 searchers.  Proposal 10: Considering the workload, network deployment and development, the CSSF enhancements relevant to FR2-1 can be focused on SA and NR-DC mode.  Proposal 11: UE can measure one serving CC per band if multiple serving CCs are in the same band.  Proposal 12: The solution of changing CSSF allocation (statically or dynamically) among PCC/PSCC/SCC can be considered.  Proposal 13: The solution of enhanced CSSF can be applied in FR1 if applicable, after the work for FR2-1 L3 measurement delay reduction is done. |
| [**R4-2408439**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408439.zip) | Qualcomm Incorporated | Proposal: RAN4 first agree the definition and implication of UE supporting multiple-RX simultaneous reception for L3 delay enhancement.   * “For UE supporting multiple-Rx simultaneous reception for L3 delay enhancement” means UE supporting “simultaneous reception of multiple SSBs from different directions of the same target frequency layer inside a SMTC window. But it does not mean “UE can process multiple SSBs from different directions of the target frequency in parallel.”   Proposal : RAN4 shall consider target scenario with applicable conditions as a package to evaluate whether/how UE to perform enhanced L3 measurement with fast beam sweeping.  Proposal : RAN4 discuss whether NW needs to know whether UE is performing fast beam sweeping.  Proposal: R19 L3 measurement enhancement for both fast beam sweeping and CSSF optimization is independent to R18 multi-rx feature. There are no features to be considered from previous release.  Proposal: NW can group among intra-frequency layers from configured MO. UE can prioritize to measure one frequency layer in each group. |
| [**R4-2408481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408481.zip) | Intel Corporation | Proposal 1: The precondition for the multi-Rx simultaneous reception to be active mode is expected to follow as much as reasonable the one we specified in Rel-18 for multi-Rx simultaneous reception features.  Proposal 2: The UE is considered activated in multi-Rx simultaneous reception mode when the UE is configured with group-based beam reporting. The UE is considered activated for L3 reporting when the GBBR is configured not long prior to the expected L3 reporting.  Proposal 3: Consider UE baseband processing capabilities when specifying the L3 delay reduction for simultaneous receptions on multiple FR2 SSB-s.  Proposal 4: The L3 measurement delay Beam Sweeping Factor can be cut half for simultaneous reception UE when only single carrier is configured.  Proposal 5: Different (or whether or not) delay reduction applies when the ratio of number of SSB within a burst and time duration of the measurement periodicity varies.  Proposal 6: RAN4 is not to compromise any other measurement performance when we consider optimization in measurement delay.  Proposal 7: RAN4 enhances the scaling factor of CSSF outside gap so that the UE is required to only measure one of the FR2 carriers and share the results among all for each band when carrying out SSB based FR2 L3 measurements.  Proposal 8: Deprioritize EN-DC scope in this work item.  Proposal 9: Consider enhancements on the number of searchers in a future release beyond Rel-19. |
| [**R4-2408596**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408596.zip) | Huawei, HiSilicon | Proposal 1: RAN4 to prioritize following scenarios for L3 measurement delay reduction by optimizing Rx BSF:  L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception when the target frequency layer to be measured is the only one in the single FR2-1 band and UE is configured with one FR2-1 band.  Considering UE supporting FR2-1 Power class 3.  Proposal 2: Do not reuse the same applicable conditions specified in Rel-18 multi-Rx (i.e. GBBR is configured)  Proposal 3: If UE is assumed to perform beam sweeping simultaneously for RRM measurement with two panels activated, at least two searchers are occupied by this single carrier.  Proposal 4:  RAN4 to prioritize following RRM procedure for L3 measurement delay reduction by optimizing Rx BSF:   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Intra-frequency measurement with MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * SSB based Inter-frequency measurement with MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter   Proposal 5: L3 measurement delay reduction by optimizing CSSFoutsidegap can be applied in:   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra, TSSB\_time\_index\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter   Proposal 6: L3 measurement delay reduction by optimizing CSSFoutsidegap can be applied in   * SA: FR2+FR2 CA, FR1+FR2 CA * NRDC: FR1+FR2 DC   Proposal 7: For UE supporting per FR gap, when all MOs are to be measured outside gap, the CSSFoutsidegap can be optimized, as these MOs can share the three searchers.  Proposal 8: Three searchers capability is naturally supported by UE who supports per FR gap and it is not a new or enhanced capability.  Proposal 9: The candidate solution of optimizing CSSF (UE only needs to measure one serving CC per band if multiple serving CCs are in the same band) can be implemented by network configuration, e.g., Only one *servingCellMO* is configured on one SCC and no MOs are configured on the other SCCs, if multiple serving CCs are in the same band.  Proposal 10: Dynamical CSSF would complicate UE implementation. |
| [**R4-2408603**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408603.zip) | Ericsson | Proposal 1: For the purpose of L3 measurement delay reduction, the L3 delay enhancements may restrict carrier configurations as follows, as a start point:   * Single carrier on FR2-1 band, as PCell, no NR CA/DC configuration. * NR CA with only a serving cell in FR2-1 band, as SCell. * NR DC with only a serving cell in FR2-1 band, as PSCell.   Proposal 2: We can have generic requirements for all power classes, maybe PC6 can be precluded, if no specific use cases for some power classes are pursued.  Proposal 3: Scenario where L3 measurement is reduced using reduced beam sweeping and scenario where L1 measurement is reduced using multiple-reception from multi-TRP for DL measurement/data are different scenarios and not expected to operate simultaneously.  Proposal 4: L3 measurement delay reduction may be influenced by L1 measurement/data transmission scheme, wherein L1 measurement may be:   * Legacy requirements or, * Enhanced requirements for Multi-Rx in Rel-18   We prefer legacy requirements between them. Once L1 measurement is chosen, we shall further check L1/L3 sharing scheme.  Proposal 5: RAN4 to study whether to specify the switch between the L1 multi-Rx and L3 multi-Rx operation occasions, e.g. minimum time period between switching.  Proposal 6: To support L3 measurement delay reduction, RAN4 shall check if those capabilities for L1 multi-RX in Rel-18, e.g., faster RX beam sweeping, enhanced scheduling and measurement restrictions and multi-Rx preference indication, can be used directly, since such definitions may simply indicate UE being in a ‘general’ multi-RX mode (not only L1 multi-RX in Rel-18).  Proposal 7: As a solution for L3 measurement delay reduction, apply the parallel L3 measurement on multiple panels at UE with less RX beam sweep factor on panels symmetrically, e.g., [4].  Proposal 8: To avoid unnecessary power consumption and computation load, enabling/disabling the parallel L3 measurement on multiple panels (if it is one of solutions addressing L3 measurement delay) may be determined by at the least one of the below options:   * Option 1: NW indicates UE enabling parallel L3 measurement on multiple panels for serving L3 measurement delay reduction through L3 or lower layers signalings. * Option 2: UE determines to apply parallel L3 measurement on multiple panels for serving L3 measurement delay reduction, and enable it after acknowledged by NW. * Option 3: UE determines to apply parallel L3 measurement on multiple panels for serving L3 measurement delay reduction if a condition is fulfilled, e.g., at cell edge. NW may be aware of it by sending a ‘allowance’ signalling or not aware of it.   Proposal 9: The WI shall prioritize the use case of the same receiver for search and measurement processing on one carrier simultaneously received from multiple panels, e.g. a single searcher receives and processes the same carrier on multiple panels.  Proposal 10: If parallel L3 measurement on multiple panels is applied, impact on scheduling restriction shall be checked. However, we don’t think enhancement on scheduling restriction is feasible.  Proposal 11: If parallel L3 measurement on multiple panels is applied, no scenario restriction (e.g., low mobility) is needed. But we may check measurement enhancement in some scenarios given parallel L3 measurement on multiple panels.  Proposal 12: UE may only measure part of spatial directions with one panel out of multiple panels. It reduces L3 measurement delay as well, upon acquiring prior knowledge on the cell to be measured, e.g.,   * The UE has measured the cell before in a time period. * The UE has knowledge on the absolute/relative location of the cell to be measured. * The UE has knowledge on its moving state (including rotation).   Proposal 13: As a particular example of the last proposal (Proposal 12), regarding the case of SSB based Intra/inter-frequency measurement, apply reduced Rx beam sweeping in the time period for subsequent operation(s) compared to the time period for prior operation(s), e.g., different Rx beam sweeping factor consequently in Tpss/sss\_sync, TSSB\_time\_index\_inter and Tssb\_measurement\_period.  Proposal 14: Prioritize the following requirements since they are most important to improve handover latency which shall be the target scenario. Apart from those cases, we also are open to other cases if noticeable value is observed.   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Intra-frequency measurement with MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * SSB based Inter-frequency measurement with MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * Handover   Proposal 15: Clarify whether ‘the case UE is capable of Rel-18 multi-Rx simultaneous reception but work in single-Rx currently’.   * Does it indicate that the UE only can use a single panel (and subsequent receiver including baseband) out of multiple panels for reception and measurement? If so, is there any degradation of reception and measurement from measuring on a single panel?   Proposal 16: RAN4 to support the following scenarios to use L3 measurement delay reduction by optimizing CSSF:   * SSB based Intra-frequency measurement without MG, * SSB based Inter-frequency measurement without MG, * NeedForGaps measurement without MG, including both with and without interruption * NCSG measurement without MG without interruption * Inter-RAT measurement without MG   Proposal 17: CSSF relevant to FR2-1 in the WI may take ‘FR2 only intra band CA’, ‘FR2 only inter band CA’, ‘FR1+FR2 CA’, ‘FR1+FR2 NR-DC’, and also EN-DC or NE-DC cases into account. Secondly, we may need to further consider contiguous or non-contiguous scenarios for such cases.  Proposal 18: RAN4 to study the mechanism of CSSF optimization, e.g., no measurement on particular CC(s), based on NW configuration/indication.  Proposal 19: If UE only measures one CC (e.g., determined by either UE or NW) out of multiple CCs, regarding measurement (including reporting) configurations to the CC and other CC(s), some promising approaches are listed as follows:   * Option 1: NW measurement configuration doesn’t cover the CC(s) not to be measured. * Option 2: NW measurement configuration covers all CC, by further (e.g. dynamical) indication,   + Option 2.1. No measurement report even measurement configuration is configured for the CC(s) which not to be measured.   + Option 2.2: If measurement configuration is configured for the CC(s) which not to be measured, the report on the CC(s) reuses the measured result of the CC to be measured.   Proposal 20: RAN4 to clarify the scope of CSSF enhancement, e.g.,   * Includes CSSF for SCCs where neighbor cell measurement isn’t required. * Doesn’t include CSSF on SCCs where neighbor cell measurement is required. * Doesn’t include CSSF on SCCs for inter-frequency without gap.   Proposal 21: CSSF enhancement also includes: prioritizing/deprioritizing CSSF by increment or decrement, for particular CC(s) or band(s) provided there are multiple CCs or multiple bands to be measured.  Proposal 22: RAN4 to study different SMTC configurations in different CCs to optimize CSSF.  Proposal 23: RAN4 to study the minimal CC number to apply CSSF enhancement.  Proposal 24: Only Rel-18 multi-Rx scenario should be assumed, and we should not assume that the UE is also supporting other features. |
| [**R4-2408895**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408895.zip) | Samsung | Proposal 1: The WID only indicates that FR2-1 SSB based L3 measurement delay reduction for connected mode is just for UE supporting multi-Rx simultaneous reception on single carrier   * The cases that simultaneous Rx operation between intra/inter-band NR carriers are precluded   Proposal 2: The applicable scenario definition “The target frequency layer to be measured is the only one in the single FR2-1 band” precludes the cases that SSB-based inter-frequency measurement and intra-frequency measurement with MG, which is not aligned to the objective  Proposal 3: RAN4 to clarify the intention and meaning of “target frequency layer to be measured is the only one in the single FR2-1 band”  Proposal 4: For the applicable scenarios of L3 measurement delay reduction by optimizing Rx BSF, UE is configured with at least one FR2-1 band  Proposal 5: Suggest to define the applicable scenario as: L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided the target carrier to be measured is the only one in the single FR2-1 band and UE is configured with at least one FR2-1 band  Proposal 6: Suggest to preclude HST at current stage and consider UE supporting FR2-1 power class 3 as first priority  Proposal 7: Rel-19 L3 measurement with multi-Rx DL reception is irrelevant to multi-TRP operation deployment |
| [**R4-2409150**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409150.zip) | Nokia, Nokia Shanghai Bell | Proposal 1: RAN4 to consider L3 BSF reduction due to multi-Rx only when CA/DC is not configured.  Proposal 2: The scenario with CA/DC configured is considered only for CSSF enhancements.  Proposal 3: RAN4 to consider L3 FBS targeting cell edge scenarios.  Proposal 4: Do not reuse Rel-18 multi Rx FBS activation conditions for Rel 19 multi Rx FBS.  Proposal 5: Discuss FBS triggering conditions among the following options:  a. Option 1: Network configuration of FBS  b. Option 2: Mobility Event triggering FBS  c. Option 3: Conditional Handover configuration  Proposal 6: The reduced beam sweeping for L3 measurements does not result in any changes to the existing measurement accuracy requirements and side conditions.  Proposal 7: RAN4 to introduce a new individual capability for L3 beam sweeping factor reduction due to multi-Rx operation.  Proposal 8: Rel-19 discussion on the scenarios for CSSF optimization will be considered in CA/DC scenarios, independently of the UE support of multi-Rx capabilities.  Proposal 9: Prioritize the application of CSSF optimization to the following measurement procedures:   * SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter and TSSB\_measurement\_period\_inter   Proposal 10: A UE capability is needed to inform network the support of reduced CSSF.  Proposal 11: The reduced CSSF shall be applied to the UE supporting the capability and starting from R19.  Proposal 12: The measurement accuracy performance shall not be degraded due to application of reduced CSSF.  Proposal 13: RAN4 to confirm if one of the searchers is assumed for PCell measurement and the other is assumed for the measurements on all the SCells.  Proposal 14: To identify the scenarios where SSB-based measurements can be relaxed so that CSSF can be optimized.  Proposal 15: To consider the CSSF optimization by minimizing the impact from CSI-RS based measurements on SSB-based measurements. |
| [**R4-2409730**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409730.zip) | MediaTek inc. | Proposal 1: The conditions in R18 multi-Rx WI do not limit the discussion on having further conditions in R19 for UE supporting multi-Rx to enhance FR2-1 SSB based L3 measurement delay.  Proposal 2: Conditions for UE to apply L3 measurement delay reduction by optimizing Rx beam sweeping factor:   * For UE at the cell-edge * For UE with high mobility * For UE at the cell-edge and with high mobility * Based on prior the knowledge of the target cell   Proposal 3: L3 measurement delay reduction (including intra/inter frequency with/without gap) by optimizing Rx beam sweeping factor are applied to one-time event/procedure scenarios that does not happen frequently, including:  • Handover event, DAPS Handover event, handover with PSCell event  • SCell activation event, SCG activation event  • PSCell addition event  Proposal 4: RAN4 to consider only 2 searchers for CSSF optimization to reduce FR2 L3 measurement delay.  Proposal 5: For L3 measurement delay reduction by optimizing CSSF, RAN4 to consider the scenarios of Intra-frequency measurement without MG and Inter-frequency measurement without MG. |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

The WID RP-240830 agreed in the RANP#103 meeting is:

|  |
| --- |
| * FR2-1 SSB based L3 measurement delay reduction for connected mode   + For UE supporting multiple-Rx simultaneous reception on single carrier:     - Study suitable scenarios and conditions and, if feasible, introduce methods to reduce FR2-1 L3 measurement delay by optimizing:       * Rx beam sweeping factor   + For UE not in multiple-Rx simultaneous reception mode:     - Study suitable scenarios and conditions and, if feasible, introduce methods to reduce FR2-1 L3 measurement delay by optimizing:       * CSSF outside gap in CA/DC scenarios         + Baseline assumption on number of searchers is 2 |

### Sub-topic 2-1 FR2-1 L3 measurement delay by optimizing Rx beam sweeping factor

*Sub-topic description:*

*Open issues and candidate options before f2f meeting:*

**Abbreviation:**

* + BSF: beam sweeping factor
  + FBS: fast beam sweeping

#### Issue 2-1-1: Applicability requirement of L3 measurement delay reduction by optimizing Rx BSF

|  |
| --- |
| WF R4-2406392   * + FFS:   + L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided the target frequency layer to be measured is the only one in the single FR2-1 band and UE is configured [with one FR2-1 band].   + RAN4 to consider UE supporting FR2-1 power class 3 as first priority. |

**Applicability requirement:**

* Option 1 (Apple, OPPO, HW):
  + L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided the target frequency layer to be measured is the only one in the single FR2-1 band and UE is configured with one FR2-1 band.
  + Option 1a (LGE):
    - L3 measurement delay enhancement in Rel-19 by optimizing Rx BSF for UE supporting multi-Rx simultaneous reception are applicable provided target frequency layer to be measured is the only single carrier for intra- / inter-frequency L3 measurement in the configured FR2-1 band but without CA configuration.
  + Option 1b (vivo):
    - L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-Rx simultaneous reception are applicable provided the target frequency layer to be measured is the single carrier and UE is configured with one FR2-1 band.
  + Option 1c (Samsung):
    - The applicable scenario definition “The target frequency layer to be measured is the only one in the single FR2-1 band” precludes the cases that SSB-based inter-frequency measurement and intra-frequency measurement with MG, which is not aligned to the objective
    - RAN4 to clarify the intention and meaning of “target frequency layer to be measured is the only one in the single FR2-1 band”
    - For the applicable scenarios of L3 measurement delay reduction by optimizing Rx BSF, UE is configured with at least one FR2-1 band
    - Suggest to define the applicable scenario as: L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided the target carrier to be measured is the only one in the single FR2-1 band and UE is configured with at least one FR2-1 band
* Option 2 (NTT DCM):
  + The number of configured MOs has not to be one if these MOs are intra-frequency layer.
  + L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided the target frequency layer to be measured belongs to the same ~~is the only one in the single~~ FR2-1 band and UE is configured ~~[~~with one FR2-1 band~~]~~.
* Option 3 (CATT):
  + It is proposed not to restrict the number of configured carriers and applied power class.
* Option 4 (ZTE):
  + For the case of single FR2-1 band allowed, multi-Rx can be applicable to both L3 measurement with gap and without gap. For the case of multiple FR2-1 bands allowed, multi-Rx is only beneficial for L3 measurement with gap.
  + When considering the number of serving cell within a band, both the impact on traffic data reception and other L3 measurement should be considered.
    - From the perspective of impact on traffic data reception, multi-Rx based L3 measurement can be performed regardless single or multiple serving cells configured in a band.
    - From the perspective of impact on other L3 measurement, to support multi-Rx based L3 measurement, the assumption of 2 searchers can not be satisfied if multiple serving cells configured.
      * To support multi-Rx based L3 measurement in multiple serving cells case, 2 searchers assumption has to be degraded into 1 searcher assumption.
* Option 5 (QC (clarification on “UE with multiple Rx reception” before the applicability)):
  + RAN4 first agree the definition and implication of UE supporting multiple-RX simultaneous reception for L3 delay enhancement.
    - “For UE supporting multiple-Rx simultaneous reception for L3 delay enhancement” means UE supporting “simultaneous reception of multiple SSBs from different directions of the same target frequency layer inside a SMTC window. But it does not mean “UE can process multiple SSBs from different directions of the target frequency in parallel.”
* Option 6 (Ericsson):
  + For the purpose of L3 measurement delay reduction, the L3 delay enhancements may restrict carrier configurations as follows, as a start point:
    - Single carrier on FR2-1 band, as PCell, no NR CA/DC configuration.
    - NR CA with only a serving cell in FR2-1 band, as SCell.
    - NR DC with only a serving cell in FR2-1 band, as PSCell.
* Option 7 (Nokia):
  + RAN4 to consider L3 BSF reduction due to multi-Rx only when CA/DC is not configured.

**UE Power class:**

* Option 1 (Apple, OPPO, LGE, vivo, HW, Samsung):
  + RAN4 to consider UE supporting FR2-1 power class 3 as first priority.
  + Option 1a (LGE):
    - but RAN4 should consider if other power classes could apply the outcome of the WI discussion
* Option 2 (CATT):
  + It is proposed not to restrict the number of configured carriers and applied power class.
* Option 3 (Ericsson):
  + We can have generic requirements for all power classes, maybe PC6 can be precluded, if no specific use cases for some power classes are pursued.
* Recommended WF
  + Moderator note: try to accommodate all the options, suggest to discuss if following can be agreed:

|  |
| --- |
| **Applicability requirement:**  Baseline: L3 delay enhancements in Rel-19 by optimizing Rx BSF for UE supporting multi-rx simultaneous reception are applicable provided that:   * the target carrier(s) to be measured: only one carrier in the single FR2-1 band is configured for intra- / inter-frequency L3 SSB measurement and * UE serving carrier(s): UE is configured with single carrier on FR2-1 band, i.e. FR2-1 PCell without CA/DC.   Note: The ‘other UE CA/DC modes (e.g., 2 FR2-1 bands CA, or FR1+FR2 CA/DC, or EN-DC)’ and/or the ‘other number of target to-be-measured carrier(s) on FR2-1 band’ can be FFS after concluding the baseline above. These extra FFS parts will NOT delay the WI completion.  **UE Power class:**  Baseline: RAN4 to consider UE supporting FR2-1 power class 3 as first priority.  Note: whether other power classes could apply the outcome of the WI discussion can be FFS after concluding on PC3. These extra FFS parts will NOT delay the WI completion.  **Other clarification on WID:**  “For UE supporting multiple-Rx simultaneous reception for L3 delay enhancement” means UE supporting “simultaneous reception of multiple SSBs from different directions of the same target frequency layer inside a SMTC window. But it does not mean “UE can process multiple SSBs from different directions of the target frequency in parallel.” |

#### Issue 2-1-2: Conditions to apply L3 measurement delay reduction by optimizing Rx BSF

[Moderator note]: The condition here means in which case/condition/use-case/mode UE can apply the L3 measurement delay reduction by optimizing Rx BSF.

|  |
| --- |
| WF R4-2406392  FFS：Conditions for UE to apply L3 measurement delay reduction by optimizing Rx BSF   * + FFS: multi-Rx simultaneous reception of UE is in active mode, which is expected to follow the one specified in Rel-18 for multi-Rx simultaneous reception features   + FFS: UE’s mobility status, e.g., whether HST is precluded or not   + FFS: RRM measurement with two panels activated, two searchers are occupied by this single carrier   + FFS: SSB processing delay/time for processing multiple beams received in a SMTC   + FFS: Power consumption issue   + FFS: UE has prior knowledge on the cell to be measured   + FFS: Rel-19 L3 measurement with multi-Rx DL reception is irrelevant to multi-TRP operation deployment   + FFS: Other conditions: cell-centre UE or cell-edge UE   + FFS: Simultaneous operation between multi-Rx simultaneous reception (L1) and L3 measurement delay reduction by optimizing Rx BSF. |

**Conditions for UE to apply L3 measurement delay reduction by optimizing Rx BSF:**

* + FFS: multi-Rx simultaneous reception of UE is in active mode, which is expected to follow the one specified in Rel-18 for multi-Rx simultaneous reception feature
    - Option 1 (Apple, CATT, ZTE, vivo, CTC, Intel): multi-Rx simultaneous reception of UE is in active mode, which is expected to follow the one specified in Rel-18 for multi-Rx simultaneous reception feature.
      * Option 1a (ZTE): The UE is in multi-Rx operation if following condition is met: UE is configured with group-based beam reporting (GBBR) report
      * Option 1b (Intel): The UE is considered activated in multi-Rx simultaneous reception mode when the UE is configured with group-based beam reporting. The UE is considered activated for L3 reporting when the GBBR is configured not long prior to the expected L3 reporting.
    - Option 2 (LGE): The L3 measurement delay enhancement requirements for UE supporting multi-Rx simultaneous reception can apply if multiple panels are activate and SSBs in a SMTC window can be measured with multiple beams.
    - Option 3 (CMCC): the conditions for UE to apply L3 measurement delay reduction by optimizing Rx BSF is that multi-Rx simultaneous reception of UE is in active mode, as for whether the condition is same as that for Rel-18 multi-Rx simultaneous reception can be further discussed.
    - Option 4 (HW, Nokia): Do not reuse the same applicable conditions specified in Rel-18 multi-Rx
    - Option 5 (MTK): The conditions in R18 multi-Rx WI do not limit the discussion on having further conditions in R19 for UE supporting multi-Rx to enhance FR2-1 SSB based L3 measurement delay

[Moderator]: discussion can be mainly focus on option 1 and 4, and then add details from other options if needed.

* + FFS: UE’s mobility status, e.g., whether HST is precluded or not
    - Option 1 (Apple, ZTE(preclude HST), vivo, CTC, Samsung(preclude HST)): low mobility status, i.e., preclude HST
    - Option 2 (CATT, CMCC): enhanced BSF can also be used for HST
    - Option 3 (Ericsson): no scenario restriction (e.g., low mobility) is needed
    - Option 4 (MTK): For UE with high mobility
  + FFS: RRM measurement with two panels activated, two searchers are occupied by this single carrier
    - Option 1 (Apple): the legacy searcher assumption and legacy CSSF shall still be applied for L3 RRM measurement with two panels activated
    - Option 1a (Ericsson):
      * The WI shall prioritize the use case of the same receiver for search and measurement processing on one carrier simultaneously received from multiple panels, e.g. a single searcher receives and processes the same carrier on multiple panels.
    - Option 2 (vivo, HW): RRM measurement with two panels activated, two searchers are occupied by this single carrier

[Moderator]: discussion can be mainly focus on option 1 and 2, and then add details from other options if needed.

* + FFS: SSB processing delay/time for processing multiple beams received in a SMTC
    - Option 1 (vivo, QC, Intel, Apple): needs SSB processing delay/time for processing multiple beams received in a SMTC
  + FFS: Power consumption issue
    - Option1 (Apple): considering power consumption, BSF reduction of L3 measurement will not trigger UE to activate multi-Rx.
    - Option 2 (LGE): For power consumption of multi-Rx operation, Rel-18 UAI ‘multiRx-PreferenceFR2’ for power saving can be considered as starting point.
    - Option 3 (Ericsson): To avoid unnecessary power consumption and computation load, enabling/disabling the parallel L3 measurement on multiple panels (if it is one of solutions addressing L3 measurement delay) may be determined by at the least one of the below options:
* Option 3-1: NW indicates UE enabling parallel L3 measurement on multiple panels for serving L3 measurement delay reduction through L3 or lower layers signalings.
* Option 3-2: UE determines to apply parallel L3 measurement on multiple panels for serving L3 measurement delay reduction, and enable it after acknowledged by NW.
* Option 3-3: UE determines to apply parallel L3 measurement on multiple panels for serving L3 measurement delay reduction if a condition is fulfilled, e.g., at cell edge. NW may be aware of it by sending a ‘allowance’ signalling or not aware of it.
  + - Option 4 (Nokia): Discuss FBS triggering conditions among the following options:
      * Option 4-1: Network configuration of FBS (similar as option 3-1)
      * Option 4-2: Mobility Event triggering FBS
      * Option 4-3: Conditional Handover configuration

[Moderator]: discussion can be mainly focus on: whether we need “additional triggering for this R19 L3 measurement with FBS” or “L3 measurement with FBS is used only if multi-Rx has already been activated based on R18 condition”. And then add details from options if needed.

* + FFS: UE has prior knowledge on the cell to be measured
    - Option 1 (CATT): on top of the UE capability of supporting Multi-Rx, no additional conditions of prior knowledge for target cell is needed
    - Option 2 (vivo, CTC, MTK): UE needs prior knowledge on the cell to be measured
      * Option 2a (CTC): It’s proposed to consider conditions of prior knowledge on the cell to be measured and discuss whether the conditions of prior knowledge are applicable
    - Option 3 (Ericsson): UE may only measure part of spatial directions with one panel out of multiple panels. It reduces L3 measurement delay as well, upon acquiring prior knowledge on the cell to be measured, e.g.,
      * The UE has measured the cell before in a time period.
      * The UE has knowledge on the absolute/relative location of the cell to be measured.
      * The UE has knowledge on its moving state (including rotation).

[Moderator]: discussion can be mainly focus on option 1 and 2, and then add details from other options if needed.

* + FFS: Rel-19 L3 measurement with multi-Rx DL reception is irrelevant to multi-TRP operation deployment
    - Option 1 (vivo, Samsung): Rel-19 L3 measurement with multi-Rx DL reception is irrelevant to multi-TRP operation deployment
  + FFS: cell-centre UE or cell-edge UE
    - Option 1 (Nokia, MTK): RAN4 to consider L3 FBS targeting cell edge scenarios
  + FFS: DRX is configured or not (newly added issue in this meeting based on Xiaomi’s proposal)
    - Option 1 (Xiaomi): SSB based L3 measurement delay reduction with DRX shall be deprioritized
  + FFS: Simultaneous operation between L3 and L1 measurements
    - Option 1 (ZTE): Simultaneous operation between L3 and L1 measurements by optimizing Rx BSF, simultaneous operation between L3 measurement and data reception by optimizing Rx BSF
    - Option 2 (Ericsson): Scenario where L3 measurement is reduced using reduced beam sweeping and scenario where L1 measurement is reduced using multiple-reception from multi-TRP for DL measurement/data are different scenarios and not expected to operate simultaneously.
      * L3 measurement delay reduction may be influenced by L1 measurement/data transmission scheme, wherein L1 measurement may be:
        + Legacy requirements or,
        + Enhanced requirements for Multi-Rx in Rel-18
      * We prefer legacy requirements between them. Once L1 measurement is chosen, we shall further check L1/L3 sharing scheme.

[Moderator]: Need to check if this measurement enhancement with simultaneous operation between L3 and L1 is in WID scope or not.

* + FFS: UE is in RRC CONNECTED mode (newly added issue in this meeting based on ZTE’s proposal)
* Option 1(ZTE): Only support multi-Rx L3 measurement for CONNECTED UE

[Moderator]: Option 1 is agreeable, it’s already clearly stated in WID.

* Recommended WF
  + Moderator note: discuss the above FFS parts.

#### Issue 2-1-3: Scenarios to use L3 measurement delay reduction by optimizing Rx BSF

[Moderator note]: The scenarios here means which UE behavior/activity/procedure(s) would be improved with this feature or which corresponding requirements in the existing RRM spec will be enhanced to accommodate this feature.

|  |
| --- |
| WF R4-2406392  FFS：Scenarios to use L3 measurement delay reduction by optimizing Rx BSF:   * FFS: SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * FFS: SSB based Intra-frequency measurement with MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra * FFS: SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * FFS: SSB based Inter-frequency measurement with MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter * FFS: Handover * FFS: PSCell addition * FFS: RRC Re-establishment/RRC Connection Release with Redirection * FFS: SCell activation * FFS: SCG activation * FFS: CGI identification * FFS: CSI-RS based intra-/inter-frequency measurements, the CSI-RS is configured *associatedSSB*   + The discussion on CSI-RS configured with associatedSSB could be revisited if SSB based L3 measurement delay reduction is concluded. |

**Which scenarios are considered to use L3 measurement delay reduction by optimizing Rx BSF:**

* + Scenario 1: SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra
    - Option 1(Apple, NTT DCM, CATT, Xiaomi, OPPO, LGE, CMCC, ZTE, CTC, HW, Ericsson): Yes
    - Option 1a (OPPO): For deactivated SCell and PSCell in FR2-1, the enhancement of TPSS/SSS\_sync and TSSB\_measurement\_period can also apply.
    - Option 2: No

[Moderator]: check if option 1/1a is agreeable.

* + Scenario 2: SSB based Intra-frequency measurement with MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra
    - Option 1(Apple, NTT DCM, CATT, Xiaomi, OPPO, LGE, CMCC, ZTE, CTC, HW, Ericsson): Yes
    - Option 2: No

[Moderator]: check if option 1 is agreeable.

* + Scenario 3: SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter
    - Option 1(Apple, NTT DCM, CATT, Xiaomi, OPPO, LGE, CMCC, ZTE, CTC, HW, Ericsson): Yes
* Option 1a (OPPO): For deactivated SCell and PSCell in FR2-1, the enhancement of TPSS/SSS\_sync and TSSB\_measurement\_period can also apply.
  + - Option 2: No

[Moderator]: check if option 1/1a is agreeable.

* + Scenario 4: SSB based Inter-frequency measurement with MG, including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter
    - Option 1(Apple, NTT DCM, CATT, Xiaomi, OPPO, LGE, CMCC, ZTE, CTC, HW, Ericsson): Yes
    - Option 2: No

[Moderator]: check if option 1 is agreeable.

* + Scenario 5: Handover
    - Option 1(NTT DCM, CATT, CMCC, ZTE, CTC, Ericsson, MTK): Yes
    - Option 2(vivo): No
    - Option 3 (Apple, Xiaomi, OPPO): After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios 1/2/3/4, the solutions(s) can be extended to this scenario

[Moderator]: check if option 1 or option 3 is agreeable.

* + Scenario 6: PSCell addition
    - Option 1(NTT DCM, ZTE, MTK): Yes
    - Option 2(vivo): No
    - Option 3 (Apple, CATT, OPPO): After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios 1/2/3/4, the solutions(s) can be extended to this scenario

[Moderator]: check if option 1 or option 3 is agreeable.

* + Scenario 7: RRC Re-establishment/RRC Connection Release with Redirection
    - Option 1(NTT DCM, ZTE): Yes
    - Option 2(vivo): No
    - Option 3 (Apple, CATT, OPPO): After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios 1/2/3/4, the solutions(s) can be extended to this scenario

[Moderator]: check if option 3 is agreeable.

* + Scenario 8: SCell activation
    - Option 1(MTK): Yes
    - Option 2(vivo): No
    - Option 3 (Apple, CATT, OPPO): After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios 1/2/3/4, the solutions(s) can be extended to this scenario

[Moderator]: check if option 3 is agreeable.

* + Scenario 9: SCG activation
    - Option 1(ZTE, MTK): Yes
    - Option 2(vivo): No
    - Option 3 (Apple, CATT, OPPO): After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios 1/2/3/4, the solutions(s) can be extended to this scenario

[Moderator]: check if option 3 is agreeable.

* + Scenario 10: CGI identification
    - Option 1 (NTT DCM, ZTE): Yes
    - Option 2(vivo): No
    - Option 3 (Apple, CATT, OPPO): After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios 1/2/3/4, the solutions(s) can be extended to this scenario.

[Moderator]: check if option 3 is agreeable.

* + Scenario 11: CSI-RS based intra-/inter-frequency measurements, the CSI-RS is configured *associatedSSB*. The discussion on CSI-RS configured with associatedSSB could be revisited if SSB based L3 measurement delay reduction is concluded.
    - Option 1: Yes
    - Option 2(vivo): No
    - Option 3 (Apple, CATT, OPPO): After RAN4 has conclusion(s) on the solution(s) of L3 measurement delay reduction for the above baseline scenarios 1/2/3/4, the solutions(s) can be extended to this scenario

[Moderator]: check if option 3 is agreeable.

* Recommended WF
  + Moderator note: to discuss the above scenarios.

#### Issue 2-1-4: Solutions to apply/specify L3 measurement delay reduction by optimizing Rx BSF

* Proposal 1 (Apple):
  + For UE supporting multiple-Rx simultaneous reception, it is proposed to reduce L3 measurement delay by reducing Rx BSF, and Rel-18 Rx BSF reduction in L1 measurement can be used as baseline.
* Proposal 1a (CTC)
  + Rx beam sweeping factor methods in Rel-18 multi-Rx/ eFeRRM WI can be considered as baseline for FR2-1 SSB based L3 measurement delay reduction.
* Proposal 2 (Xiaomi):
  + UE multiple RX beams shall be used for the same cell’s measurement in order to reduce L3 measurement delay.
  + In order to shorten the overall L3 measurements delay, the smaller RX beam sweeping factor for SSB index acquiring and SSB measurement can be used in comparison with that for PSS/SSS detection.
* Proposal 3 (LGE):
  + RAN4 to discuss how to reduce M values for SSB based intra- / inter-frequency measurements for UE supporting multi-Rx simultaneous reception
* Proposal 4 (QC):
  + RAN4 discuss whether NW needs to know whether UE is performing fast beam sweeping.
* Proposal 5 (Intel):
  + The L3 measurement delay Beam Sweeping Factor can be cut half for simultaneous reception UE when only single carrier is configured.
  + Different (or whether or not) delay reduction applies when the ratio of number of SSB within a burst and time duration of the measurement periodicity varies.
* Proposal 6 (Ericsson):
  + RAN4 to study whether to specify the switch between the L1 multi-Rx and L3 multi-Rx operation occasions, e.g. minimum time period between switching.
  + As a solution for L3 measurement delay reduction, apply the parallel L3 measurement on multiple panels at UE with less RX beam sweep factor on panels symmetrically, e.g., [4].
  + Regarding the case of SSB based Intra/inter-frequency measurement, apply reduced Rx beam sweeping in the time period for subsequent operation(s) compared to the time period for prior operation(s), e.g., different Rx beam sweeping factor consequently in Tpss/sss\_sync, TSSB\_time\_index\_inter and Tssb\_measurement\_period.
* Recommended WF
  + TBA

#### Issue 2-1-5: measurement performance requirement when apply L3 measurement delay reduction by optimizing Rx BSF

* Option 1 (Apple, CATT, CTC, Intel, Nokia):
  + RAN4 is not to change existing measurement performance requirement when consider optimization of Rx BSF in L3 measurement delay reduction.
* Option 1a (Apple):
  + The accuracy test requirement for Rx BSF optimization in L3 measurement delay reduction can be FFS.
* Recommended WF
  + [Moderator]: Check if option 1 and 1a can be agreed.

#### Issue 2-1-6: feature capability of L3 measurement delay reduction by optimizing Rx BSF

* Option 1(Apple, vivo, Nokia):
  + RAN4 to introduce a new individual capability for L3 BSF reduction due to multi-Rx operation in R19.
  + Option 1a(Apple): fine to delay the capability discussion to the end of the core part.
* Option 2 (Ericsson):
  + To support L3 measurement delay reduction, RAN4 shall check if those capabilities for L1 multi-RX in Rel-18, e.g., faster RX beam sweeping, enhanced scheduling and measurement restrictions and multi-Rx preference indication, can be used directly, since such definitions may simply indicate UE being in a ‘general’ multi-RX mode (not only L1 multi-RX in Rel-18).
* Recommended WF
  + [Moderator]: to discuss if option 1 can be agreed.

#### Issue 2-1-7: scheduling/measurement restriction relaxation

* Option 1 (Ericsson):
  + If parallel L3 measurement on multiple panels is applied, impact on scheduling restriction shall be checked. However, we don’t think enhancement on scheduling restriction is feasible.
* Recommended WF
  + [Moderator]: it’s out of scope of WI in moderator’s view.
  + Can be confirmed during the meeting.

#### Issue 2-1-8: Other WID scope discussion

* Proposal 1(Samsung): The WID only indicates that FR2-1 SSB based L3 measurement delay reduction for connected mode is just for UE supporting multi-Rx simultaneous reception on single carrier
  + The cases that simultaneous Rx operation between intra/inter-band NR carriers are precluded
* Recommended WF
  + [Moderator]: check if proposal 1 is agreeable.

### Sub-topic 2-2 FR2-1 L3 measurement delay by optimizing CSSF outside gap in CA/DC

*Sub-topic description:*

*Open issues and candidate options before f2f meeting:*

#### Issue 2-2-1: Clarification on the bullets in WID for this CSSF optimization

|  |
| --- |
| In WID:  For UE not in multiple-Rx simultaneous reception mode:   * + - Study suitable scenarios and conditions and, if feasible, introduce methods to reduce FR2-1 L3 measurement delay by optimizing:       * CSSF outside gap in CA/DC scenarios         + Baseline assumption on number of searchers is 2   Agreement in WF R4-2406392:  Rel-19 discussion on CSSF optimization starts for the case UE is not capable of Rel-18 multi-Rx simulaeous reception, further discuss whether/how it can be applied to the case UE is capable of Rel-18 multi-Rx simulaeous reception but work in single-Rx currently. |

* Option 1 (Apple): Rel-19 CSSF optimization applies for the both cases: (1)UE is not capable of Rel-18 multi-Rx simultaneous reception, (2)UE is capable of Rel-18 multi-Rx simultaneous reception but work in single-Rx currently.
* Option 2 (ZTE): Besides the case UE is not capable of R18 multi-Rx simultaneous reception, R19 CSSF optimization is also applied to the case that UE is capable of multi-Rx but not configured with GBBR report.
* Option 3 (Ericsson): Clarify whether ‘the case UE is capable of Rel-18 multi-Rx simultaneous reception but work in single-Rx currently’.
  + Does it indicate that the UE only can use a single panel (and subsequent receiver including baseband) out of multiple panels for reception and measurement? If so, is there any degradation of reception and measurement from measuring on a single panel?
* Option 4 (Nokia): Rel-19 discussion on the scenarios for CSSF optimization will be considered in CA/DC scenarios, independently of the UE support of multi-Rx capabilities.
* Recommended WF
  + Moderator note: to address the issue raised in option 3, following edit from Moderator for FFS. If companies cannot achieve consensus on option 1/2/3, RAN4 can start work firstly with UE is not capable of Rel-18 multi-Rx simultaneous reception.
  + Option 4:
    - Rel-19 CSSF optimization applies for the both cases: (1)UE is not capable of Rel-18 multi-Rx simultaneous reception, (2)UE is capable of Rel-18 multi-Rx simultaneous reception but not activated the multi-Rx simultaneous reception.

#### Issue 2-2-2: UE measurement procedure to use L3 measurement delay reduction by optimizing CSSF

|  |
| --- |
| WF R4-2406392:  Agreement:   * + Only consider CSSF outside MG case.   Proposal for further discussion:   * + Scenarios to use L3 measurement delay reduction by optimizing CSSF:     - SSB based Intra-frequency measurement without MG, including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra     - SSB based Inter-frequency measurement without MG, including TPSS/SSS\_sync\_inter and TSSB\_measurement\_period\_inter |

* Option 1: the following scenarios in CA/DC to use L3 measurement delay reduction by optimizing CSSF shall be prioritized:
  + SSB based Intra-frequency measurement without MG (Apple, CATT, CMCC, vivo, CTC, HW, Nokia, MTK)
    - Alt1: including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra
    - Alt2: including TPSS/SSS\_sync\_intra, TSSB\_time\_index\_intra and TSSB\_measurement\_period\_intra
  + SSB based Inter-frequency measurement without MG, (Apple, CATT, CMCC, vivo, CTC, HW, Nokia, MTK)
    - Alt1: including TPSS/SSS\_sync\_inter and TSSB\_measurement\_period\_inter
    - Alt2: including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter
  + Inter-RAT SSB measurement without MG (CMCC, Ericsson)
  + NeedForGaps measurement without MG, including both with and without interruption (Ericsson)
  + NCSG measurement without MG without interruption (Ericsson)
* Recommended WF
  + Moderator note: to check if following option from Moderator can be accepted.
  + Option 2:
    - the following scenarios in CA/DC to use L3 measurement delay reduction by optimizing CSSF shall be prioritized:
      * SSB based Intra-frequency measurement without MG
        + including TPSS/SSS\_sync\_intra and TSSB\_measurement\_period\_intra (note: FR2 intra-freq measurement does not have SSB index reading)
      * SSB based Inter-frequency measurement without MG,
        + including TPSS/SSS\_sync\_inter, TSSB\_time\_index\_inter and TSSB\_measurement\_period\_inter

#### Issue 2-2-3: Applicability requirement of L3 measurement delay reduction by optimizing CSSF

* Option 1 (Apple, CATT, OPPO, CMCC, ZTE): RAN4 to consider following CA/DC mode for L3 measurement delay reduction by optimizing CSSFoutside\_gap,i
  + EN-DC (Apple, CATT, OPPO, CMCC, ZTE, Ericsson):
    - Intel proposed to deprioritize EN-DC
  + NE-DC (Apple, CATT, OPPO, CMCC, ZTE, Intel, Ericsson):
  + SA (Apple, CATT, OPPO, CMCC, ZTE, CTC, Intel, HW):
    - FR2+FR2 CA (HW), FR1+FR2 CA (HW, Ericsson), FR2 only intra band CA (Ericsson), FR2 only inter band CA (Ericsson)
  + NR-DC (Apple, CATT, OPPO, CMCC, ZTE, CTC, Intel)
    - FR1+FR2 NR-DC (HW, Ericsson)
* Recommended WF
  + Moderator note:
    - Can RAN4 choose the intersection set among above options as following?
    - Option 2:
      * RAN4 to consider following CA/DC mode for L3 measurement delay reduction by optimizing CSSFoutside\_gap,i:
        + SA

FR2+FR2 CA, FR1+FR2 CA, FR2 only intra band CA, FR2 only inter band CA

* + - * + NR-DC

FR1+FR2 NR-DC

#### Issue 2-2-4: Searcher assumption to apply L3 measurement delay reduction by optimizing CSSF

|  |
| --- |
| In WID:  For UE not in multiple-Rx simultaneous reception mode:   * + - Study suitable scenarios and conditions and, if feasible, introduce methods to reduce FR2-1 L3 measurement delay by optimizing:       * CSSF outside gap in CA/DC scenarios         + Baseline assumption on number of searchers is 2 |

* Option 1 (Apple, CTC, Intel, MTK): RAN4 only consider the R19 enhancement based on 2 searchers.
* Option 2 (CATT, CMCC): enhance R19 CSSF outside gap by considering both 2 searchers and 3 searchers.
* Option 2a (HW): enhance R19 CSSF outside gap by considering 3 searchers for per FR gap capable UE.
* Option 4 (Nokia):
  + RAN4 to confirm if one of the searchers is assumed for PCell measurement and the other is assumed for the measurements on all the SCells.
* Recommended WF
  + Moderator note: if companies cannot achieve consensus, RAN4 work can start with the baseline assumption in WID, i.e., 2 searchers.

#### Issue 2-2-5: Solutions to apply/specify L3 measurement delay reduction by optimizing CSSF outside gap in CA/DC

* Option 1 (Apple, CTC, Intel, Ericsson): UE only needs to measure one serving CC per band if multiple serving CCs are in the same band
* Option 1a (Apple): details of option 1 is:
  + If PCC in the band, measure PCC
  + Otherwise if PSCC in the band, measure PSCC
  + Otherwise if SCC is in the band, measure the SCC with neighbor cell MO
  + Otherwise up to UE implementation
* [Opponent view]Option 1b (HW): The candidate solution of optimizing CSSF (UE only needs to measure one serving CC per band if multiple serving CCs are in the same band) can be implemented by network configuration, e.g., Only one *servingCellMO* is configured on one SCC and no MOs are configured on the other SCCs, if multiple serving CCs are in the same band.
* Option 1c(Ericsson):
  + If UE only measures one CC (e.g., determined by either UE or NW) out of multiple CCs, regarding measurement (including reporting) configurations to the CC and other CC(s), some promising approaches are listed as follows:
    - Option 1c-1: NW measurement configuration doesn’t cover the CC(s) not to be measured.
    - Option 1c-2: NW measurement configuration covers all CC, by further (e.g. dynamical) indication,
      * Option 1c-2.1. No measurement report even measurement configuration is configured for the CC(s) which not to be measured.
      * Option 1c-2.2: If measurement configuration is configured for the CC(s) which not to be measured, the report on the CC(s) reuses the measured result of the CC to be measured.
* Option 2 (Apple, CTC): UE can reduce the searcher occupancy ratio of PCC or PSCC measurement to speed up SCC measurement for some conditions
  + The conditions can be FFS.
  + [Opponent view] (HW): Dynamical CSSF would complicate UE implementation.
* Option 3 (OPPO):
  + RAN4 to discuss the optimization of counting the number of configured SCell(s) or MOs without MG for *CSSFoutside\_gap* in FR2 L3 measurements.
* Option 4 (Ericsson):
  + RAN4 to study the mechanism of CSSF optimization, e.g., no measurement on particular CC(s), based on NW configuration/indication.
  + CSSF enhancement also includes: prioritizing/deprioritizing CSSF by increment or decrement, for particular CC(s) or band(s) provided there are multiple CCs or multiple bands to be measured.
  + RAN4 to study different SMTC configurations in different CCs to optimize CSSF.
  + RAN4 to study the minimal CC number to apply CSSF enhancement.
* Option 5 (Nokia):
  + To identify the scenarios where SSB-based measurements can be relaxed so that CSSF can be optimized.
  + To consider the CSSF optimization by minimizing the impact from CSI-RS based measurements on SSB-based measurements.
* Option 6 (QC):
  + NW can group among intra-frequency layers from configured MO. UE can prioritize to measure one frequency layer in each group.
* Option 7 (Huawei):
* Recommended WF
  + Moderator note:
    - the option 1 has most support, to check if option 1 can be the starting point.
    - If issue 2-2-4 concluded on 3 searchers, then 3 searchers based solution can also be discussed.

#### Issue 2-2-6: measurement performance requirement when apply L3 measurement delay reduction by optimizing CSSF

* Option 1 (Apple, CATT, OPPO, Nokia):
  + RAN4 is not to change existing measurement performance requirement when consider optimization of CSSF in L3 measurement delay reduction.
* Recommended WF
  + Moderator note:
    - check if option 1 can be agreed.

#### Issue 2-2-7: feature capability of L3 measurement delay reduction by optimizing CSSF

* Option 1 (Apple, Nokia):
  + RAN4 to introduce a new individual capability for CSSF reduction in R19.
* Option 1a (Apple): fine to delay the capability discussion to the end of the core part.
* Option 1b (Nokia)
  + The reduced CSSF shall be applied to the UE supporting the capability and starting from Release 19.
* Recommended WF
  + Moderator note:
    - check if option 1/1b can be agreed.

#### Issue 2-2-8: Other WID scope discussion

* Proposal 1(CMCC, CTC): after FR2-1 L3 measurement delay reduction by optimizing CSSF is concluded, the technical solutions can be extended to FR1 if applicable.
* Proposal 2(Ericsson): RAN4 to clarify the scope of CSSF enhancement, e.g.,
  + Includes CSSF for SCCs where neighbor cell measurement isn’t required.
  + Doesn’t include CSSF on SCCs where neighbor cell measurement is required.
  + Doesn’t include CSSF on SCCs for inter-frequency without gap
* Recommended WF
  + [Moderator note]: Proposal 1 is out of current WID scope, need RAN plenary discussion for WID revision.

### Sub-topic 2-3 Common aspects for L3 measurement delay reduction

*Sub-topic description:*

*Open issues and candidate options before f2f meeting:*

#### Issue 2-3-1: whether and/or which previous release feature shall also be considered in “FR2-1 SSB based L3 measurement delay reduction for connected mode”

|  |
| --- |
| WF R4-2406392:  FFS in next meeting:   * Moderator note: * encourage companies to provide view on which features in previous release shall be considered for “FR2-1 SSB based L3 measurement delay reduction for connected mode” by optimizing Rx beam sweeping factor * encourage companies to provide view on which features in previous release shall be considered for “FR2-1 SSB based L3 measurement delay reduction for connected mode” by optimizing CSSF outside gap |

* Option 1 (Apple):
  + for “FR2-1 SSB based L3 measurement delay reduction for connected mode” by optimizing Rx beam sweeping factor, R18 feature of FR2 multi-Rx reception shall be considered
  + for “FR2-1 SSB based L3 measurement delay reduction for connected mode” by optimizing CSSF outside gap, both R16 inter-frequency measurement without MG and R18 inter-RAT measurement without MG shall be considered.
* Option 2 (LGE, QC):
  + RAN4 not to consider SSB based L3 measurement delay enhancement with previous release features.
  + R19 L3 measurement enhancement for both fast beam sweeping and CSSF optimization is independent to R18 multi-Rx feature. (QC)
* Option 3 (Ericsson):
  + Only Rel-18 multi-Rx scenario should be assumed, and we should not assume that the UE is also supporting other features.
* Recommended WF
  + TBA