**3GPP TSG-RAN WG4 Meeting #109 R4-23xxxxx**

**Chicago, USA, November 13 – 17, 2023**

**Agenda item:** 8.24.4

**Source:** Apple

**Title:** Topic summary for [109][224] NR\_Mob\_enh2\_part2

**Document for:** Information

# Introduction

This summary includes the proposals from companies on the following topics:

* NR-DC with selective activation of cell groups via L3 enhancements
* Improvement on SCell/SCG setup delay
* Enhanced CHO configurations
* RRM performance requirements of R18 Further NR mobility enhancement

Moderator’s recommendation is also provided under issue.

# Topic #1: NR-DC with selective activation of cell groups via L3 enhancements

## Companies’ contributions summary

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| **TDoc** | **Source** | **Proposals** |
| [**R4-2319792**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319792.zip) | Nokia, Nokia Shanghai Bell | Proposal 1: The delay requirement for Subsequent PSCell addition are defined as: Tconfig\_PSCell\_Addition\_Conditional = TEvent\_DU + Tmeasure + TUE\_preparation + Tprocessing + T∆ + TPSCell\_ DU + 2 msTEvent\_DU is the delay uncertainty which is the time from when the UE successfully transmits an RRCReconfigurationComplete message confirming the release of SCG configuration until a condition exists at the measurement reference point which will trigger the conditional PSCell addition.  Tmeasure is the measurements time stated in clause 8.9A.2.1. TUE\_preparation is the UE preparation time for conditional PSCell addition, and starts after UE realizes the condition of PSCell addition is met and identity of the PSCell is determined. TUE\_preparation is up to 10 ms. Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing = 20 ms when PSCell is in FR1, and Tprocessing = 40ms when PSCell is in FR2. T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = 1\*Trs ms. TPSCell\_ DU is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. TPSCell\_ DU is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in Table 8.1-1 of TS 38.213 [3].  |
| [**R4-2319793**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319793.zip) | Nokia, Nokia Shanghai Bell | draftCR on NR-DC with selective activation of cell groups via L3 enhancements |

## Open issues summary

### Sub-topic 1-1 Subsequent PSCell Addition

**Issue 1-1-1: whether to define RAN4 delay requirement for Subsequent PSCell addition**

* Candidate solutions:
	+ Option 1: Yes (Nokia)
* Recommended WF
	+ Agree on option 1.

**Issue 1-1-2: The delay requirement for Subsequent PSCell addition**

* Candidate solutions:
	+ Option 1: (Nokia)

Tconfig\_PSCell\_Addition\_Conditional = TEvent\_DU + Tmeasure + TUE\_preparation + Tprocessing + T∆ + TPSCell\_ DU + 2 ms

* + TEvent\_DU is the delay uncertainty which is the time from when the UE successfully transmits an RRCReconfigurationComplete message confirming the release of SCG configuration until a condition exists at the measurement reference point which will trigger the conditional PSCell addition.
	+ Tmeasure is the measurements time stated in clause 8.9A.2.1.
	+ TUE\_preparation is the UE preparation time for conditional PSCell addition, and starts after UE realizes the condition of PSCell addition is met and identity of the PSCell is determined. TUE\_preparation is up to 10 ms.
	+ Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing = 20 ms when PSCell is in FR1, and Tprocessing = 40ms when PSCell is in FR2.
	+ T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = 1\*Trs ms.
	+ TPSCell\_ DU is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. TPSCell\_ DU is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in Table 8.1-1 of TS 38.213 [3].
* Recommended WF
	+ Discuss delay requirement for Subsequent PSCell addition based on option 1.

# Topic #2: Improvement on SCell/SCG setup delay

## Companies’ contributions summary

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| **TDoc** | **Source** | **Proposals** |
| [**R4-2318327**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318327.zip) | CATT | **Observation 1: The relationship between R16 EMR and R18 enhancement to SCell/SCG setup delay is related to the coexistence of R16 EMR and R18 enhancement, and it will have an impact on the design of signalling by RAN2, so it is important to align the understanding.****Proposal 1: R18 fast FR2 CA/DC setup is independent to EMR feature.*** **It does not exclude reusing the R16 mechanism for R18 enhancement.**

**Proposal 2: For condition A, it is hard to determine the exact value of X and whether to consider multiple [X] per UE mobility speed should be discussed.** **Observation 2: Considering that R18 fast FR2 CA/DC setup is independent to EMR feature is supported, if the new network assistant information is introduced, the UE incapable of EMR can also reuse existing network assistant information and it is very helpful.****Proposal 3: NW provides explicit measurement information for fast CA/DC setup either upon RRC release or broadcast. The measurement information can include target frequency, Cell ID, and target SSB info.****Proposal 4: NW may specify a target band among candidate bands via system information.*** **It can be discussed in RAN2.**
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| [**R4-2318605**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318605.zip) | Apple | **Proposal 1: in R18 enhancement to SCell/SCG setup delay, solutions based on existing idle/inactive measurement for cell reselection purpose and enhanced measurement are independent of UE support of R16 EMR.****Proposal 2: confirm that in solution based on existing measurement the reported measurement results satisfy measurement accuracy at the measurement instance.****Observation 1: necessity of new indication of measurement status for solutions based on enhanced measurement is questionable. Without indicating the measurement status in idle/inactive mode when entering CONNECTED mode, UE can still complete the measurement and report the measurement results earlier if possible.****Observation 2: UE may continue the “on-going” measurement after the ending point, i.e., receiving MO configuration (if the on-going measurement is on one of the carriers in the MO configuration). However, it is not feasible to define measurement requirement to cover the time span from the starting point and ending point of enhanced measurement.****Observation 3: UE is allowed to continue the measurements in CONNECTED mode if all newly configured MOs align with the frequency layers to be measured in the IDLE/INACTIVE mode. However, feasibility of defining RRM requirements to quantify how many samples are needed upon connection setup is questionable.****Proposal 3: candidate values for X: [1s, 2s, 5s and 60s].****Proposal 4: Whether to perform addition measurement starting from RRC connection setup/resume procedure can be up to UE implementation. It is not feasible to define measurement delay requirements between the starting point and ending point for the enhanced measurement.****Observation 4: UE needs to know measurement configuration for enhanced measurement.****Proposal 5: for solution based on enhanced measurement, context in existing MeasIdleCarrierNR-r16 can be reused. However, RAN4 can also leave it to RAN2 whether to introduce new measurement configuration or to reuse existing EMR configuration****Proposal 6: for solution based on enhanced measurement:*** **Existing accuracy requirements defined in clause 10.1 for RRC connected mode apply for the measurement report after MO configuration for RRC connected mode in scenario 2.**
* **After MO configuration for RRC connected mode, existing RRM requirements including measurement period, reporting latency, accuracy apply to all the MO.**

**Proposal 7: UE feature list for this objective:**

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.NR\_Mob\_enh2 | 39-5 | Measurement validation during connection setup/resume | Improvement on SCell/SCG setup delay based on existing measurement |  | [Yes] | N/A | UE does not support measurement validation during connection setup/resume | [Per-UE] | [No] | [Yes] | N/A |  | Optional with capability signaling |
|  | [39-6] | Enhanced measurement during RRC connection setup/resume | Improvement on SCell/SCG setup delay based on enhanced measurement during RRC connection setup/resume |  | [Yes] | N/A | UE does not support enhanced measurement during RRC connection setup/resume | [Per-UE] | No | [Yes] | N/A |  | Optional with capability signaling |

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| [**R4-2318606**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318606.zip) | Apple |  Draft CR on FR2 SCell/SCG setup delay improvement |
| [**R4-2318607**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318607.zip) | Apple |  LS on FR2 SCell/SCG setup delay improvement |
| [**R4-2319060**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319060.zip) | vivo | **Proposal 1: For definition of ‘valid’ in solution based on existing measurement, RAN4 to define {5s, 10s, 20s, 50s, 100s} as candidate value(s) of X.****Proposal 2: For the definition of ‘valid’ in solution based on existing measurement, RAN4 to add ‘there is no cell reselection occurred before reporting’ as the side condition.****Proposal 3: For enhanced measurement which starts from RRC setup/resume procedure*** + - **Existing accuracy requirements defined in clause 10.1 for RRC connected mode apply for the measurement report after MO configuration for RRC connected mode in scenario 2.**
		- **After MO configuration for RRC connected mode, existing RRM requirements including measurement period, reporting latency, accuracy apply to all the MO.**
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| [**R4-2319083**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319083.zip) | CMCC | ***Proposal 1: Rel-16 EMR and R18 enahcement to SCell/SCG setup delay are independent features.******Proposal 2: in order to reduce the number of EMR carriers to be measured for improved measurement, network could provide assistance information, e.g. threshold(s)of serving cell’s quality, to help UE to reduce the number of EMR carriers to be measuremed during RRC setup/resume procedure.*** ***Proposal 3: with the previous agreements on ending point of enhanced solution (i.e. ending point is the reception of the 1st RRC\_reconfiguration message), no need to introduce a measurement status of ongoing measurement when entering connected mode.******Observation 1: even if newly configured MOs aligned with the on-going measured frequency layers during RRC setup, it cannot be assumed that these MOs are potentially for SCell/SCG setup, it can also be used for mobility. The reason is that the carrier for fast SCell/SCG setup is configured by previous serving or camped cell, but UE may connect to a different cell.******Observation 2: if UE continue performing idle/inactive measurement after MO configuration, following issues are identified and need to be addressed**** ***How to define measurement related requirements for the MO(s)***
* ***Whether legacy measurement period, measurement reporting requirements, accuracy requirements for connected state can be applied?***
* ***How to avoid its impact on the configured recommended sequence for intra/inter-RAT/inter-frequency measurement and reporting***

***Proposal 4: it is proposed to follow previous agreement on ending point of enhanced measurement, and the enhanced measurement is stopped at the ending point.**** ***the ending point of enhanced solution is agreed as the reception of the RRC CONNECTED mode measurement configuration (the 1st RRC\_reconfiguration message).***
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| [**R4-2319303**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319303.zip) | ZTE Corporation | **Observation 1: For the value of X, 5 seconds are widely used in legacy requirements and it is recommended to reuse.****Proposal 1: Existing measurement is considered valid if the measurement are performed within the last [5] seconds before it is reported and the reported measurement results satisfy measurement accuracy [at the measurement instance]****Proposal 2: NW provide explicit measurement information for fast CA/DC setup either upon RRC release or broadcast. The measurement information can include target frequency, Cell ID, and target SSB info.****Proposal 3: Continue the measurements in CONNECTED mode if newly configured MOs aligned with the on-going measured frequency layers during RRC setup.****Proposal 4: After MO configuration for RRC connected mode, existing RRM requirements including measurement period, reporting latency, accuracy apply to all the MO. No new requirements for enhanced measurement are expected.** |
| [**R4-2319324**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319324.zip) | LG Electronics Inc. | **Proposal 1: During the additional measurement, for the further validity check, reduced samples and (or) reduced beam sweeping factors can be considered. (LGE)** |
| [**R4-2319373**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319373.zip) | Huawei, HiSilicon | **Proposal 1: R16 EMR and R18 enhancement of SCG setup are independent features.****Proposal 2: Existing measurement results are regarded as valid if the measurement is performed within the last [5] seconds before it is reported in option A.****Proposal 3: The** **reported measurement results satisfy measurement accuracy at the measurement instance in option B.****Proposal 4: When UE enters to connected mode, according agreed starting point and ending point, the gain of allowing UE perform enhanced measurement just dozens of milliseconds before RRC reconfiguration is not outstanding. Furthermore the measurement requirement of the enhanced solution is hard to be quantitatively specified.****Observation 1: The solution of allowing UE continue measurement on certain layer after RRC reconfiguration further extends the agreed ending point.****Proposal 5: The solution of allowing UE continue measurement on certain layer after RRC reconfiguration may fasten event trigger on the MO which is aligned with the on-going measured layer than the other MOs. This may cause some “unfair” factor from network side.** **Proposal 6: For enhanced FR2 measurement, to guarantee the measurement accuracy, the measurement samples are not supposed to be reduced.****Proposal 7: For enhanced FR2 measurement, not to reduce the scaling factor of Rx beam sweeping during the RRC connection setup/resume procedure.** |
| [**R4-2319488**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319488.zip) | OPPO | ***Proposal 1: R18 fast FR2 CA/DC setup is independent to EMR feature.******Observation 1: All the results reported to NW should be considered as valid without additional indication.******Proposal 2: Two conditions for valid measurement results should be met:*** * ***measurements are performed within the last [X] seconds before it is reported. X= 5s, or 60s. The value is network configured.***
* ***the reported measurement results satisfy measurement accuracy.***

***Proposal 3：For solution based on enhanced measurement, RAN4 to discuss and decide whether to introduce indication for validation or indication for availability when entering connected mode:******(option 1) introduce new indication for validation status to inform the network for validation of measurements or (option 2) reuse the legacy indication (i.e., idleMeasAvailable) or new indication for availiablity, included in RRCResumeComplete or RRCSetupComplete.******Observation 2: After MO configuration for RRC connected mode, existing RRM requirements including measurement period, reporting latency, accuracy apply to all the MO.******Proposal 4: RAN4 to define requirements for enhanced measurement which starts from RRC setup/resume procedure under scenario 2 that MO configuration for RRC connected at least includes the carrier that being measured during the RRC idle/inactive status.******Proposal 5: Not reduce the scaling factor of Rx beam sweeping when defining requirements for the new measurement during RRC connection setup/resume.*** |
| [**R4-2319631**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319631.zip) | MediaTek Inc. |  **Proposal 1: One of the candidate values of X can be 5s.****Proposal 2: Reuse the same side conditions configured on RSRP or RSRQ for EMR.** **Proposal 3: For the solution based on enhanced measurement, the delay requirements would be the same as legacy measurement requirements in CONNECTED mode.****Proposal 4: If the measurement results are reported through EMR, the results reported should satisfy the accuracy requirements defined for EMR. If the measurement results are reported in CONNECTED mode measurement report, the results should satisfy accuracy requirements defined for measurement in CONNECTED mode.****Proposal 5: The necessity of introducing new UE capability depends on whether new indication from NW is agreed or not.****Proposal 6: Further discuss how to capture the solution based on enhanced measurement in the spec when discussing CR.****Proposal 7: Introduce an optional UE capability to indicate supporting validation of measurement results obtained in idle/inactive mode for early report when enters connected mode. The details are as follows:**

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| **Features** | 39 NR\_Mob\_enh2 |
| **Index** | 39-x |
| **Feature group** | Measurement validation during connection setup/resume |
| **Components** | Support of measurement validation during connection setup/resume |
| **Prerequisite feature groups** | 　 |
| **Need for the gNB to know if the feature is supported** | Yes |
| **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | N/A |
| **Consequence if the feature is not supported by the UE** | UE does not support measurement validation during connection setup/resume |
| **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Per-UE |
| **Need of FDD/TDD differentiation** | No |
| **Need of FR1/FR2 differentiation** | Yes |
| **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | N/A |
| **Note** |  |
| **Mandatory/Optional** | Optional with capability signaling |

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| [**R4-2319794**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319794.zip) | Nokia, Nokia Shanghai Bell |  [**Proposal 1: For feature group definitions. Capabilities are independent but can coexist:**](#_Toc149915065)[**a.** **[*existing-measurement-solution-r18*]: UE supporting existing measurement solution does not perform new measurements starting from, and during RRCSetup/Resume procedure and while in CONNECTED mode.**](#_Toc149915066)[**b.** **[*enhanced-measurement-solution-r18*]: UE is capable, and may perform new measurements starting from, and during RRCSetup/Resume procedure and while in CONNECTED mode.**](#_Toc149915067)[**Proposal 2: RAN4 to clarify what “the measurements are performed within the last [X] seconds before it is reported” means for the existing measurement solution.**](#_Toc149915068)[**Observation 1:** Reporting configuration for [existing*-measurement-solution-r18*] is release-18 specific and does not impact legacy reporting. Signalling is up to RAN2.](#_Toc149915069)[**Observation 2:** Reporting configuration for [*existing-measurement-solution-r18*] is controlled by the network operator, hence it is up to the network configuration to decide which measurements UE reports. Signalling is up to RAN2.](#_Toc149915070)[**Proposal 3: Details of the reporting are up to RAN2.**](#_Toc149915071)[**Observation 3:** RAN4 has previously agreed “UE is allowed to perform addition measurement starting from RRC connection setup/resume procedure”.](#_Toc149915072)[**Proposal 4: UE supporting [*enhanced-measurement-solution-r18*] capability is allowed to perform measurements starting from and during RRC Setup/Resume and while in CONNECTED mode.**](#_Toc149915073)[**Proposal 5: UEs supporting [*enhanced-measurement-solution-r18*], when needed, is expected to continue measurements after RRC Setup/Resume procedure, hence the duration of the RRC-Setup/Resume procedure is not a limiting factor.**](#_Toc149915074)[**Proposal 6: Assuming that UE has already performed measurements prior entering the connected mode. Therefore, the time to perform measurements is much shorter in many cases.**](#_Toc149915075)[**Observation 4:** UE has time to perform measurements:](#_Toc149915076)[1. during RRC setup procedure,](#_Toc149915077)[2. during security establishment, and](#_Toc149915078)[3. until the reception of the RRC CONNECTED mode measurement configuration (the 1st RRC\_reconfiguration message)](#_Toc149915079)[4. after the measurement configuration, as in legacy, if the measurement configuration includes an overlapping carrier.](#_Toc149915080)[**Observation 5:** UEs supporting [*enhanced-measurement-solution-r18*] shall always follow the measurement and reporting configuration. I.e., there is no legacy impact](#_Toc149915081)[**Observation 6:** Reporting configuration for [enhanced*-measurement-solution-r18*] is release-18 specific and does not impact legacy reporting. Signalling is up to RAN2.](#_Toc149915082)[**Observation 7:** Reporting configuration for [enhanced*-measurement-solution-r18]* is controlled by the network operator, hence it is up to the network configuration to decide which measurements UE reports. Signalling is up to RAN2.](#_Toc149915083)[**Proposal 7: The following (option 1):**](#_Toc149915084)[**a.Existing accuracy requirements defined in clause 10.1 for RRC connected mode apply for the measurement report after MO configuration for RRC connected mode in scenario 2.**](#_Toc149915085)[**b.After MO configuration for RRC connected mode, existing RRM requirements including measurement period, reporting latency, accuracy apply to all the MO.**](#_Toc149915086)[**Proposal 8: For [enhanced-measurement-solution-r18], from the network point of view, it is absolutely necessary to know whether UE is performing measurements or not. Without the indication network does not know whether UE is measuring or not. Therefore:**](#_Toc149915087)[**a.** **Introduce a measurement status indication at RRC setup/resume complete, consisting e.g. of the following options: 1. No measurements available, 2. Valid measurements available, 3. Measurements ongoing.**](#_Toc149915088)[**Observation 8:** Introducing a threshold would change the idle-mode measurement behaviour. RAN4#105 agreed the enhancements on IDLE/INACTIVE mode measurement are not in the scope. This was later scoped out in the WID.](#_Toc149915089)[**Proposal 9: NW provides explicit measurement and measurement reporting information for [enhanced-measurement-solution-r18] either upon RRCRelease message or SIB message. The measurement information can include target frequency, Cell ID, and target SSB info.**](#_Toc149915090)[**Proposal 10: Number of samples UE needs to measure can depend on UE radio conditions and measurement conditions. Measurement period can be up to 8xTssb SSB samples.**](#_Toc149915091)[**Proposal 11: UE is supporting [enhanced-measurement-solution-r18] is not assumed to start the measurements from the scratch. Therefore, UE is not need time for to perform full beam-sweeping and the scaling factor associated with the beam sweeping can be reduced.**](#_Toc149915092)[**Proposal 12: UE capabilities [enhanced-measurement-solution-r18] and [existing-measurement-solution-r18] are independent from UE supporting IdleInactiveMeasurements-r16. Signalling is up to RAN2.**](#_Toc149915093)[**Proposal 13: Cell reselection is RAN2 issue and does not need clarification from RAN4 point of view. No need for LS on cell reselection either.**](#_Toc149915094) |
| [**R4-2319795**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319795.zip) | Nokia, Nokia Shanghai Bell |  draftCR for 38.133 on Improvement on SCell/SCG setup delay |
| [**R4-2320491**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320491.zip) | Qualcomm Incorporated | **Proposal: NW provides explicit measurement configurations for R18 FR2 CA/DC setup at RRC release or it is broadcasted (SIB11). (e.g, SSB frequency, SSB periodicity, Cell ID, etc)****Proposal: R18 FR2 CA/DC setup feature is independent to R16 EMR.** * **Dedicate measurement configurations and reporting structure for R18 FR2 CA/DC setup enhancements are required.**

**When UE to check the validity based on [X]sec?****Observation**: RAN4 agreed that EMR reporting framework is reused for this feature. In other words, UE will indicate for available measurement results and then report after CONNECTED state. Therefore, when UE indicate the measurement results it should be valid and the validity should be no changes due to time span after indication. **Observation**: If UE check the validity at reporting occasion, UE may drop the measurement results depends on [X] but it is already indicated as “available results” in msg5. Therefore, it is reasonable to perform validity check before msg5. Paging occasion could be one option. However, paging has periodic occasion. So, it could make unnecessary validity check. Since msg1 transmission is the first step of RRC resume/setup request for both MO/MT call, it is reasonable that UE to perform a validity check upon msg1 transmission. **Proposal: UE perform a validation check upon msg1 transmission instead of reporting occasion.** **Proposal: Available measurements results for reporting in msg5 should be valid and the validity is not changed due to time span until actual reporting.** **What measurement results are valid from the validity check?****Proposal: If accuracy requirements are met, the measurement results are valid for*** **IDLE/INACTIVE measurements within the last [X] sec before msg1 transmission for RRC resume/setup request.**
* **Measurements performed after msg1 transmission for RRC resume/setup request.**

**What side conditions trigger a validity check?****Observation**: if measurement configuration is provided in RRC release for fast CA/DC setup, it is natural that EMR is configured. However, it is up to UE implementation performing measurement after T331 timer expiry, apply [X] can imply UE shall perform the measurement even after T331 timer expire. In order to apply [X], the T331 timer is not expired before the last [X] second before msg1 transmission. **Proposal: UE perform a validity check if the following conditions:*** **If NW explicitly configured measurement configurations for R18 fast FR2 CA/DC setup,**
	+ **If the FR2 configurations are broadcasted in SIB11, measurement configuration are not changed in SIB11 during IDLE/INACTIVE state,**
	+ **Otherwise, validity check is not performed.**
	+ **If the configurations are provided upon RRC release**
		- **EMR needs to be configured.**
		- **T331 timer does not expire within the last [X] sec before msg1 transmission.**
	+ **Otherwise, validity check is not performed.**
* **Otherwise, UE does not perform a validity check.**

**What measurements are not affected from a validity check?****Proposal: The validity check is not applicable to** * **Any measurements during IDLE/INACTIVE but not related to R18 fast FR2 CA/DC setup.**
* **R16 EMR measurements reporting, if EMR is configured.**
* **Any measurements during CONNECTED mode.**

**When UE receive [X] information?** **Proposal**: **If measurement configurations are provided in RRC Release, [X] is provided in RRC release, If measurement configurations are broadcasted in SIB11, [X] is provided in SIB11.** **Additional measurement requirements** **Proposal: RAN4 concludes that there is no feasibility issue to continue perform measurement after CONNECTED state from operation perspective, when newly configured MO for CONNECTED states contains at least measurement configurations for FR2 CA/DC setup.****Proposal: There is no impact to legacy reporting from continuing measurements because MO is configured for CONNECTED state regardless of IDLE/IANCTIVE measurement results.** **Proposal: Accuracy requirements for CONNECTED state is applied for additional measurements for FR2 CA/DC setup for scenario 2. No requirement is specified for other cases.**  |
| [**R4-2320621**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320621.zip) | Ericsson | [**Proposal 1: RAN 4 shall align view on how Rel-16 capability and Rel-18 capability coexist and indicate RAN2 for signalling design.**](#_Toc149834746)[**Proposal 2: The configurable validity value shall consider value from 5s to 300s.When the validity value is not configured, it is default as value infinite.**](#_Toc149834747)[**Proposal 3: RAN4 108 meeting agreement shall be followed and UE shall not continue performing Idle/Inactive enhanced measurement after reception of the RRC connected mode measurement configuration (the 1st RRC\_reconfiguration message).**](#_Toc149834748) |
| [**R4-2320623**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320623.zip) | Ericsson |  Draft CR to 38.133 for improvement for scg\_scell setup dealy enhancement |

## Open issues summary

### Sub-topic 2-1 scope and overall solution

**Issue 2-1-1: relationship between R16 EMR and R18 enahcement to SCell/SCG setup delay**

* Candidate solutions:
	+ Option 1: Rel-16 EMR and R18 enhancement to SCell/SCG setup delay are independent features. (CMCC, HW, OPPO, QC, CATT, Nokia)
	+ Option 1a: R18 fast FR2 CA/DC setup is independent to EMR feature. It does not exclude reusing the R16 mechanism for R18 enhancement. It also means that separate signalling will be defined for R18 enhancement and R16 EMR, so that the NW could identify which measurement result is reported due to R18 enhancement feature. (CATT)
	+ Option 1b: in R18 enhancement to SCell/SCG setup delay, solutions based on existing idle/inactive measurement for cell reselection purpose and enhanced measurement are independent of UE support of R16 EMR. (Apple)
	+ Option 1c: Dedicate measurement configurations and reporting structure for R18 FR2 CA/DC setup enhancements are required. (QC)
	+ Option 1d: UE capabilities [enhanced-measurement-solution-r18] and [existing-measurement-solution-r18] are independent from UE supporting IdleInactiveMeasurements-r16. Signalling is up to RAN2. (Nokia)
	+ Option 2: RAN 4 shall align view on how Rel-16 capability and Rel-18 capability coexist and indicate RAN2 for signalling design. (E///)

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| --- | --- | --- |
| Capability  | Can work independently? | Can coexsit with? |
| Rel-16 EMR | YES | Rel-18 solution1 & solution 2 capability  |
| Rel-18 solution 1  | YES | Rel-16 EMR & Rel-18 solution 2 |
| Rel-18 solution 2 | No | Rel-16 EMR & Rel-18 solution 1 |

* + Option 2a: For feature group definitions. Capabilities are independent but can coexist (Nokia)
		1. [existing-measurement-solution-r18]: UE supporting existing measurement solution does not perform new measurements starting from, and during RRCSetup/Resume procedure and while in CONNECTED mode.
		2. [enhanced-measurement-solution-r18]: UE is capable, and may perform new measurements starting from, and during RRCSetup/Resume procedure and while in CONNECTED mode.
* Recommended WF
	+ Discuss candidate solutions.

**Issue 2-1-2: UE feature group**

* Candidate solutions:
	+ Option 1: (Apple)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.NR\_Mob\_enh2 | 39-x1 | Measurement validation during connection setup/resume | Improvement on SCell/SCG setup delay based on existing measurement |  | [Yes] | N/A | UE does not support measurement validation during connection setup/resume | [Per-UE] | [No] | [Yes] | N/A |  | Optional with capability signaling |
|  | [39-x2] | Enhanced measurement during RRC connection setup/resume | Improvement on SCell/SCG setup delay based on enhanced measurement during RRC connection setup/resume |  | [Yes] | N/A | UE does not support enhanced measurement during RRC connection setup/resume | [Per-UE] | No | [Yes] | N/A |  | Optional with capability signaling |

* + Option 2: (vivo)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 39.NR\_Mob\_enh2(MeasIdleFR2-CarrierNR-r18) | 39-1 | Support of FR2 measurements during RRC connection setup/resume | 1.Support of FR2 measurements during RRC connection setup/resume2.Support of continuing FR2 measurements after RRC connection setup/resume | - | YES | NO | 1.UE doesn’t support of FR2 measurements during RRC connection setup/resume | Per UE | No | FR2 only | No |  | Optional with capability signalling |
| 39.NR\_Mob\_enh2(fr2-MeasIdleAvailable-r18) | 39-2 | Support availability indication of IDLE/INACTIVE mode FR2 measurements | 1.Support availability indication of IDLE/INACTIVE mode FR2 measurements for UE which is not capable of idleInactiveNR-MeasBeamReport-r16 |  | Yes | No | 1. UE doesn’t support availability indication of IDLE/INACTIVE mode FR2 measurements if UE is not capable of idleInactiveNR-MeasBeamReport-r16 | Per UE | No | FR2 only | No |  | Optional with capability signalling |

* + Option 3: (MTK)

|  |  |
| --- | --- |
| **Features** | 39 NR\_Mob\_enh2 |
| **Index** | 39-x |
| **Feature group** | Measurement validation during connection setup/resume |
| **Components** | Support of measurement validation during connection setup/resume |
| **Prerequisite feature groups** | 　 |
| **Need for the gNB to know if the feature is supported** | Yes |
| **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | N/A |
| **Consequence if the feature is not supported by the UE** | UE does not support measurement validation during connection setup/resume |
| **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Per-UE |
| **Need of FDD/TDD differentiation** | No |
| **Need of FR1/FR2 differentiation** | Yes |
| **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | N/A |
| **Note** | 　 |
| **Mandatory/Optional** | Optional with capability signaling |

* Recommended WF
	+ Continue discuss based on the following:
		1. UE feature group for solution based on existing measurement:

|  |  |
| --- | --- |
| **Features** | 39 NR\_Mob\_enh2 |
| **Index** | 39-x1 |
| **Feature group** | Measurement validation during connection setup/resume |
| **Components** | Support of measurement validation during connection setup/resume |
| **Prerequisite feature groups** | 　 |
| **Need for the gNB to know if the feature is supported** | Yes |
| **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | N/A |
| **Consequence if the feature is not supported by the UE** | UE does not support measurement validation during connection setup/resume |
| **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Per-UE |
| **Need of FDD/TDD differentiation** | No |
| **Need of FR1/FR2 differentiation** | Option 1: Yes (Apple, MTK)Option 2: FR2 only (vivo) |
| **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | N/A |
| **Note** | 　 |
| **Mandatory/Optional** | Optional with capability signaling |

* + 1. UE feature group for solution based on enhanced measurement:

|  |  |
| --- | --- |
| **Features** | 39 NR\_Mob\_enh2 |
| **Index** | 39-x2 |
| **Feature group** | Enhanced measurement during RRC connection setup/resume |
| **Components** | Support of enhanced measurement during RRC connection setup/resume |
| **Prerequisite feature groups** | 　 |
| **Need for the gNB to know if the feature is supported** | Yes |
| **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | N/A |
| **Consequence if the feature is not supported by the UE** | UE does not support enhanced measurement during RRC connection setup/resume |
| **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Per-UE |
| **Need of FDD/TDD differentiation** | No |
| **Need of FR1/FR2 differentiation** | Option 1: Yes (Apple)Option 2: FR2 only (vivo) |
| **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | N/A |
| **Note** | 　 |
| **Mandatory/Optional** | Optional with capability signaling |

**Issue 2-1-3: Update definition of valid measurement results (based on outcome of issue 2-2-4)**

* Candidate solutions:
	+ Proposal 1: If accuracy requirements are met, the measurement results are valid for : (QC)
		- IDLE/INACTIVE measurements within the last [X] sec before msg1 transmission for RRC resume/setup request.
		- Measurements performed after msg1 transmission for RRC resume/setup request.

### Sub-topic 2-2 solutions based on existing measurement

* Agreements in RAN4#108bis:
	+ The measurements are considered valid if both of the following conditions are satisfied
		- A) the measurement are performed within the last [X] seconds before it is reported
			* X value is network configured. Signalling details are up to RAN2
			* FFS on the X value(s) and will be decided by RAN4
			* If X is not defined then no requirements will be introduced
		- B) the reported measurement results satisfy measurement accuracy [at the measurement instance]
		- FFS on side conditions

**Issue 2-2-1: ‘X’ value**

* Candidate solutions:
	+ Whether to consider multiple values of [X]?
		- Yes, consider multiple values of [X] (Apple, vivo, OPPO, E//, CATT)
			* Option 1: 1s, 2s, 5s and 60s. (Apple)
			* Option 2: 5s, 10s, 20s, 50s, 100s (vivo)
			* Option 3: 5s, 60s (OPPO)
			* Option 4:
				+ Option 4a: 5s to 300s. When the validity value is not configured, it is default as value infinite. (E///)
				+ Option 4b: Value range is defined between [T1] and [T2]
		- Option 5: Multiple values of X with “spare” fields. No, only consider single value of [X]. (ZTE, HW, MTK)
* Option 5: 5s (ZTE, HW, MTK)Recommended WF
	+ Discuss candidate solutions.

**Issue 2-2-2: the reported measurement results satisfy measurement accuracy [at the measurement instance]**

* Candidate solutions:
	+ Option 1: confirm that in solution based on existing measurement the reported measurement results satisfy measurement accuracy at the measurement instance. (Apple, [ZTE], HW)
	+ Option 2:
		- A UE supporting [Existing-measurement-solution-r18] shall report measurements fulfilling the following criteria:
			* At the time of reporting, samples associated with the measurement report meeting the accuracy requirements, specified in [10.1], is performed within the [RRC-time-X-r18] configured in TS 38.331.
* Recommended WF
	+ Discuss candidate solutions.

**Issue 2-2-3: side conditions**

* Candidate solutions:
	+ Proposal 1: there is no cell reselection occurred before reporting. (vivo)
	+ Proposal 2: Reuse the same side conditions configured on RSRP or RSRQ for EMR. (MTK)
	+ Proposal 3: UE perform a validity check if the following conditions: (QC)
		- If NW explicitly configured measurement configurations for R18 fast FR2 CA/DC setup,
			* If the FR2 configurations are broadcasted in SIB11, measurement configuration are not changed in SIB11 during IDLE/INACTIVE state,
			* Otherwise, validity check is not performed.
			* If the configurations are provided upon RRC release
				+ EMR needs to be configured.
				+ T331 timer does not expire within the last [X] sec before msg1 transmission.
			* Otherwise, validity check is not performed.
		- Otherwise, UE does not perform a validity check.
	+ Proposal 4: The validity check is not applicable to: (QC)
		- Any measurements during IDLE/INACTIVE but not related to R18 fast FR2 CA/DC setup.
		- R16 EMR measurements reporting, if EMR is configured.
		- Any measurements during CONNECTED mode.
* Recommended WF
	+ Discuss candidate solutions.

**Issue 2-2-4: others**

* Candidate solutions:
	+ Proposal 1: RAN4 to clarify what “the measurements are performed within the last [X] seconds before it is reported” means for the existing measurement solution. (Nokia)
	+ Proposal 2: UE perform a validation check upon msg1 transmission instead of reporting occasion (QC)
	+ Proposal 3: If measurement configurations are provided in RRC Release, [X] is provided in RRC release,
	If measurement configurations are broadcasted in SIB11, [X] is provided in SIB11. (QC)
* Recommended WF
	+ Discuss candidate solutions.

### Sub-topic 2-3 solutions based on enhanced measurement

**Issue 2-3-1: whether it is necessary to indicate measurement status when entering connected mode.**

* Candidate solutions:
	+ Option 1: no (Apple, CMCC)
		- Option 1a: necessity of new indication of measurement status for solutions based on enhanced measurement is questionable. Without indicating the measurement status in idle/inactive mode when entering CONNECTED mode, UE can still complete the measurement and report the measurement results earlier if possible. (Apple)
		- Option 1b: with the previous agreements on ending point of enhanced solution (i.e. ending point is the reception of the 1st RRC\_reconfiguration message), no need to introduce a measurement status of ongoing measurement when entering connected mode. (CMCC)
		- Option 2: yes (Nokia)From the network point of view, it is necessary to know whether UE is performing measurements or not. Without the indication network does not know whether UE is measuring or not. Therefore:
			* Introduce a measurement status indication at RRC setup/resume complete, consisting e.g. of the following options: 1. No measurements available, 2. Valid measurements available, 3. Measurements ongoing.
	+ Option 3: discuss and decide whether to introduce indication for validation or indication for availability when entering connected mode (OPPO)
		- Alt 1: introduce new indication for validation status to inform the network for validation of measurements.
		- Alt 2: reuse the legacy indication (i.e., idleMeasAvailable) or new indication for availability, included in RRCResumeComplete or RRCSetupComplete.
* Recommended WF
	+ Discuss candidate solutions.

**Issue 2-3-2: UE measurement behavior after receiving MO configuration in connected mode**

* Candidate solutions:
	+ Option 1: It is up to UE implementation to continue the measurements in CONNECTED mode if newly configured MOs aligned with the on-going measured frequency layers during RRC setup. (Apple)
	+ Option 1a: UE supporting [*enhanced-measurement-solution-r18*] capability is allowed to perform measurements starting from and during RRC Setup/Resume and while in CONNECTED mode. (Nokia)
	+ Option 2: Continue the measurements in CONNECTED mode if newly configured MOs aligned with the on-going measured frequency layers during RRC setup. (ZTE)
	+ Option 2a: UEs supporting [*enhanced-measurement-solution-r18*], when needed, is expected to continue measurements after RRC Setup/Resume procedure, hence the duration of the RRC-Setup/Resume procedure is not a limiting factor. (Nokia)
	+ Option 3: follow previous agreement on ending point of enhanced measurement, and the enhanced measurement is stopped at the ending point. If UE continue performing idle/inactive measurement after MO configuration, following issues are identified and need to be addressed (CMCC)
		- How to define measurement related requirements for the MO(s)
			* Whether legacy measurement period, measurement reporting requirements, accuracy requirements for connected state can be applied?
		- How to avoid its impact on the configured recommended sequence for intra/inter-RAT/inter-frequency measurement and reporting
	+ Option 3a: The solution of allowing UE continue measurement on certain layer after RRC reconfiguration may fasten event trigger on the MO which is aligned with the on-going measured layer than the other MOs. This may cause some “unfair” factor from network side. (HW)
	+ Option 3b: RAN4 108 meeting agreement shall be followed and UE shall not continue performing Idle/Inactive enhanced measurement after reception of the RRC connected mode measurement configuration (the 1st RRC\_reconfiguration message). (E///)
* Recommended WF
	+ Discuss candidate solutions.

**Issue 2-3-3: network assistant information and measurement configuration**

* Candidate solutions:
	+ Proposal 1: NW provides explicit measurement information for fast CA/DC setup either upon RRC release or broadcast. The measurement information can include target frequency, Cell ID, and target SSB info. (CATT, ZTE)
	+ Proposal 2: NW may specify a target band among candidate bands via system information. It can be discussed in RAN2. (CATT)
	+ Proposal 3: UE needs to know measurement configuration for enhanced measurement. Context in existing MeasIdleCarrierNR-r16 can be reused. However, RAN4 can also leave it to RAN2 whether to introduce new measurement configuration or to reuse existing EMR configuration, since RAN2 has already been discussing this issue. (Apple)
	+ Proposal 4: in order to reduce the number of EMR carriers to be measured for improved measurement, network could provide assistance information, e.g. threshold(s)of serving cell’s quality, to help UE to reduce the number of EMR carriers to be measured during RRC setup/resume procedure. (CMCC)
	+ Proposal 5: NW provides explicit measurement and measurement reporting information for [enhanced-measurement-solution-r18] either upon RRCRelease message or SIB message. The measurement information can include target frequency, Cell ID, and target SSB info. (Nokia)
* Recommended WF
	+ Discuss candidate solutions.

**Issue 2-3-4: feasibility or necessity of RRM requirements for enhanced measurement which starts from RRC setup/resume procedure.**

* WF in RAN4#108bis:
* Definition of scenarios:
	+ Scenario 1: measurement object configuration for RRC connected does NOT include the carrier that being measured during the RRC idle/inactive status.
	+ Scenario 2: measurement object configuration for RRC connected at least includes the carrier that being measured during the RRC idle/inactive status.
* Continue discussion on the following solutions:
	+ Option 1: (Supporting companies: Vivo, MTK, QC, Nokia, Apple, ZTE, OPPO, Xiaomi)
		- Existing accuracy requirements defined in clause 10.1 for RRC connected mode apply for the measurement report after MO configuration for RRC connected mode in scenario 2.
		- After MO configuration for RRC connected mode, existing RRM requirements including measurement period, reporting latency, accuracy apply to all the MO.
	+ Option 2: (Supporting companies: CMCC, E///)
		- FFS
* Candidate solutions:
	+ Option 1: (Apple, [ZTE], Nokia, [QC])
		- Existing accuracy requirements defined in clause 10.1 for RRC connected mode apply for the measurement report after MO configuration for RRC connected mode in scenario 2.
		- After MO configuration for RRC connected mode, existing RRM requirements including measurement period, reporting latency, accuracy apply to all the MO.
	+ [Option 2:
		- Option 2a (HW): When UE enters to connected mode, according agreed starting point and ending point, the gain of allowing UE perform enhanced measurement just dozens of milliseconds before RRC reconfiguration is not outstanding. Furthermore the measurement requirement of the enhanced solution is hard to be quantitatively specified.Option 2b (Nokia): UEs supporting [enhanced-measurement-solution-r18], when needed, is expected to continue measurements after RRC Setup/Resume procedure, hence the duration of the RRC-Setup/Resume procedure is not a limiting factor.]
	+ Option 3: OPPO
		- define requirements for enhanced measurement which starts from RRC setup/resume procedure under scenario 2 that MO configuration for RRC connected at least includes the carrier that being measured during the RRC idle/inactive status.
	+ Option 4: MTK
		- Option 4a (MTK):
			* For the solution based on enhanced measurement, the delay requirements would be the same as legacy measurement requirements in CONNECTED mode.
			* If the measurement results are reported through EMR, the results reported should satisfy the accuracy requirements defined for EMR. If the measurement results are reported in CONNECTED mode measurement report, the results should satisfy accuracy requirements defined for measurement in CONNECTED mode.
		- Option 4b (Nokia):
			* Assuming that UE has already performed measurements prior entering the connected mode. Therefore, the time to perform measurements is much shorter in many cases.
* Recommended WF
	+ Discuss candidate solutions.

**Issue 2-3-5: number of samples, including whether Rx beam sweeping is needed**

* Candidate solutions:
	+ Option 1: During the additional measurement, for the further validity check, reduced samples and (or) reduced beam sweeping factors can be considered. (LGE)
	+ Option 2: For enhanced FR2 measurement, to guarantee the measurement accuracy, the measurement samples are not supposed to be reduced. Not to reduce the scaling factor of Rx beam sweeping during the RRC connection setup/resume procedure. (HW)
	+ Option 2a: Not reduce the scaling factor of Rx beam sweeping when defining requirements for the new measurement during RRC connection setup/resume. (OPPO)
	+ Option 3: Number of samples UE needs to measure can depend on UE radio conditions and measurement conditions. Measurement period can be up to 8xTssb SSB samples. UE is supporting [enhanced-measurement-solution-r18] is not assumed to start the measurements from the scratch. Therefore, UE is not need time for to perform full beam-sweeping and the scaling factor associated with the beam sweeping can be reduced. (Nokia)
* Recommended WF
	+ Discuss candidate solutions.

# Topic #3: Enhanced CHO configurations

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc** | **Source** | **Source** |
| [**R4-2318608**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318608.zip) | Apple |  Draft CR on Enhanced CHO configurations |
| [**R4-2319059**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319059.zip) | vivo | **Observation 1: For CHO with CPAC procedure, before target PCell is determined, UE would apply SMTC configuration based on the timing reference of source cell.****Proposal 1: Keep the current agreements on requirement on PSCell delay and no further differentiation between both parallel and sequential cell search procedures for CHO with CPAC (obj.4)*** + **When the UE is NOT provided with CHO-only configuration**
		- **DCHOwithPSCell\_PSCell = TRRC + TEvent\_DU + max (Tmeasure\_CHO, Tmeasure\_CPA/CPC) + TCHO\_execution + Tprocessing + T∆\_PSCell + TPSCell\_ DU + 2 ms,**
			* **Tmeasure for CHO is used as baseline for Tmeasure\_CHO**
			* **Tmeasure for CPA/CPC is used as baseline for Tmeasure\_CPA/CPC**
 |
| [**R4-2319285**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319285.zip) | Nokia, Nokia Shanghai Bell | 1. **Do not introduce the term Tsearch\_PCell for the delay requirement DCHOwithPSCell\_PSCell.**
 |
| [**R4-2319286**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319286.zip) | Nokia, Nokia Shanghai Bell |  Draft CR on CHO with CPC requirements |
| [**R4-2319304**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319304.zip) | ZTE Corporation | **Proposal 1: Tmeasure for CPA/CPC is used as baseline for Tmeasure\_CPA/CPC and Tsearch\_PCell is no needed in Tmeasure\_CPA/CPC for PSCell handover delay in CHO including target MCG and candidate SCG.** |
| [**R4-2319374**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319374.zip) | Huawei, HiSilicon | **Proposal 1: When complementary CHO-only configuration is not configured, Tmeasure= max{Tmeasure\_PCell, Tmeasure\_PSCell}; When the CHO execution condition is met but no CPC execution condition is met, if there is an available CHO-only or Rel-17 CHO with SCG configuration for which the CHO condition is met, Tmeasure for CHO specified in existing clause 6.1.4 can be reused.** |

## Open issues summary

### Sub-topic 3-1 CHO including target MCG and target SCG in NR-DC (obj. 3)

N/A

### Sub-topic 3-2 CHO including target MCG and candidate SCG for CPC/CPA in NR-DC (obj. 4)

**Issue 3-2-1: PSCell delay when the UE is NOT provided with CHO-only configuration**

* Candidate solutions:
	+ Option 1: Do not introduce the term Tsearch\_PCell for the delay requirement DCHOwithPSCell\_PSCell. (Nokia, vivo, ZTE)
* Recommended WF
	+ Already reflected in big CR (R4-2317436) endorsed in RAN4#108bis. Keep current requirements unchanged.

**Issue 3-2-2: Tmeasure**

* Candidate solutions:
	+ Option 1: When complementary CHO-only configuration is not configured, Tmeasure= max{Tmeasure\_PCell, Tmeasure\_PSCell}; When the CHO execution condition is met but no CPC execution condition is met, if there is an available CHO-only or Rel-17 CHO with SCG configuration for which the CHO condition is met, Tmeasure for CHO specified in existing clause 6.1.4 can be reused. (HW)
* Recommended WF
	+ Already reflected in big CR (R4-2317436) endorsed in RAN4#108bis. Keep current requirements unchanged.

# Topic #4: RRM performance requirements of R18 Further NR mobility enhancement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc** | **Source** | **Proposals** |
| [**R4-2318328**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318328.zip) | CATT |  **Proposal 1: Test cases for L1 intra- and inter-frequency measurements should be specified in RAN4 and more details should wait for core part conclusion, that is:*** **Test cases for intra-frequency L1-RSRP measurement**
* **Test cases for inter-frequency L1-RSRP measurement**

**Proposal 2: Test cases for for LTM cell switch delay requirements are at least related to the following aspects:*** **RACH-based or RACH-less**
* **Frequency range of serving cell and target cell, intra- or inter**
* **Whether the target TCI state is on the active TCI state list**
* **Whether the target cell is a current serving cell or not an active serving cell**

**Proposal 3: RAN4 to introduce test case for testing a subsequent Conditional PSCell change.****Proposal 4: RAN4 to define the following two test cases for subsequent Conditional PSCell change:*** **Subsequent conditional PSCell change delay (intra-frequency CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC)**
* **Subsequent conditional PSCell change delay (inter-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC)**

**Proposal 5: Introduce test cases for CHO including target MCG and target SCG in NR-DC (obj.3) and CHO including target MCG and candidate SCG in NR-DC (obj.4).****Proposal 6: Test parameters in test cases for CHO and HO with PSCell can be used as baseline for CHO with target and candidate PSCell.****Proposal 7: For the scope and scenario, we support to define test cases for both FR1+FR2 and FR1+FR1 NR-DC.****Proposal 8: If UE is provided with CHO-only configuration, and PSCell condition is not met at this point, the UE proceeds with CHO without CPC and the existing test case for CHO can be reused.** |
| [**R4-2318609**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318609.zip) | Apple | **Proposal 1: introduce the following two test cases for subsequent Conditional PSCell Change:*** **FR1-FR1 NR-DC to FR1-FR1 NR-DC**
* **FR1-FR1 NR-DC to FR1-FR2 NR-DC (with testability issue)**

**Proposal 2: test parameters in existing conditional PSCell addition can be used as baseline for subsequent Conditional PSCell Change test cases.****Observation 1: From RRM requirements point of view, the new procedure in obj.3 is very similar with existing procedures of conditional handover plus handover with PSCell.****Proposal 3: RAN4 can consider a new test case to verify the new measurement result validity procedure, e.g. use one EMR test case as baseline, and then add the newly introduced timer X. TE shall trigger measurement report after T331 expires and with X second window.****Proposal 4: given that UE anyway has to pass conditional handover test cases and handover with PSCell test cases, no need to introduce new test case for conditional Handover including target MCG and target SCG (obj.3).****Proposal 5: introduce the following two test cases for conditional handover including target MCG and candidate SCG:*** **FR1-FR1 NR-DC to FR1-FR1 NR-DC**
* **FR1-FR1 NR-DC to FR1-FR2 NR-DC (with testability issue)**

**Proposal 6: test parameters in test cases for conditional handover and handover with PSCell can be used as baseline for conditional handover including target MCG and candidate SCG.****Proposal 7: No need to define test case for CHO with candidate PSCell for the case when CPC condition is not met and the UE proceeds with CHO-only.** |
| [**R4-2319065**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319065.zip) | vivo | **Proposal 1: RAN4 to define the test cases for NR-DC with selective activation of cell groups via L3 enhancements as below. Specifically, add the TC2 to list of tests in TS 38.133 v17.10.0 clause A.3.13A if there are still testability issues after assessment.*** **TC1: Subsequent conditional PSCell change delay (intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC)**
* **TC2: Subsequent conditional PSCell change delay (inter-frequency CPC from FR1-FR1 NR-DC to FR1-FR2 NR-DC)**

**Proposal 2: Test parameters in existing conditional PSCell addition can be used as baseline for subsequent Conditional PSCell Change test cases.****Proposal 3: RAN4 to define the test cases for Enhanced CHO including target MCG and target SCG (obj.3) as below:** * **TC1: Conditional handover with PSCell change from NR-DC to NR-DC with parallel processing (both PCell and PSCell are in FR1)**
* **TC2: Conditional handover with PSCell change from NR-DC to NR-DC with sequential processing (PCell is in FR1 and PSCell is in FR2)**

**Proposal 4: RAN4 to define test cases related to FR1-FR2 joint testing for Enhanced CHO configurations (both Obj.3 and Obj.4) and add them to list of tests in TS 38.133 v17.10.0 clause A.3.13A if there are still testability issues after assessment.****Proposal 5: RAN4 to define the test cases for Enhanced CHO including target MCG and candidate SCGs for CPC (obj.4) as below:** * **TC1: Conditional handover with conditional PSCell change from NR-DC to NR-DC (from FR1-FR1 to FR1-FR1)**
* **TC2: Conditional handover with conditional PSCell change from NR-DC to NR-DC (from FR1-FR1 to FR1-FR2)**
 |
| **[R4-2319082](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319082.zip)** | CMCC | ***Proposal 1: it is proposed to define test for NR-DC with selective activation of cell groups via L3 enhancements.******Proposal 2: For enhanced CHO, it is proposed to define test for both FR1+FR2 and FR1+FR1 NR-DC.******Proposal 3: for CHO including target MCG and target SCG in NR-DC, it is proposed to define tests to cover both PCell handover delay and PSCell handover delay.******Proposal 4: for CHO including target MCG and candidate SCG for CPC/CPA, it is proposed to define tests for following cases:**** ***when the CHO execution condition is met but no CPC execution condition is met, and CHO-only configuration is provided***
* ***CHO-only configuration is not provided***

***Proposal 5: for intra-frequency L1-RSRP measurement, the legacy L1-RSRP accuracy requirements specified in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively can be reused at least for UE capable of RTD>CP.******Proposal 6: it is proposed to define accuracy requirements for inter-frequency L1-RSRP measurement.*** |
| [**R4-2319287**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319287.zip) | Nokia, Nokia Shanghai Bell | [**Proposal 1: For subsequent-CPAC testing of PSCell change delay, introduce a new test case to test the delay requirement for PSCell change after a PSCell change.**](#_Toc149902320)[**Proposal 2: Define LTM L1-RSRP measurement test cases for intra- and inter-frequency measurements. The details are pending core part conclusion.**](#_Toc149902321)[**Observation 1:** No need to define a separate test case for early TCI state activation. Early TCI state activation impact should be tested in cell switch test cases.](#_Toc149902322)[**Proposal 3: RAN4 to consider defining a test case for early TA acquisition based on PDCCH order separately from LTM cell switch and/or together with LTM cell switch. Details of the test case(s) are pending core part agreements.**](#_Toc149902323)[**Proposal 4: On high level, for LTM cell switch, RAN4 to consider defining test cases for**](#_Toc149902324)* **RACH-based cell switch with TCI activation+indication at cell switch command**
* **RACH-based cell switch with early TCI state activation**
* **RACH-less cell switch with TCI state activation+indication at cell switch command**
* **RACH-less cell switch with early TCI state activation**

**Details of each test case including e.g. further scenarios and UE capabilities that impact the cell switch delay are to be considered once agreed in the core part.**[**Proposal 5: For eEMR, define test cases for verifying measurement accuracy of UE reported idle/inactive mode measurements for the cases with and without enhanced measurements. The details of the measurements and reporting are depending on further RAN4 and RAN2 agreements.**](#_Toc149902325)[**Proposal 6: For CHO enhancements, test cases for testing the delay and interruption for PCell and PSCell should be defined for:**](#_Toc149902326) * **CHO with target PSCell (FR1+FR1 and FR1+FR2)**
* **CHO with candidate PSCell (FR1+FR1 and FR1+FR2)**

[**Observation 2:** No need to define test case for CHO with candidate PSCell for the case when CPC condition is not met and the UE proceeds with CHO-only.](#_Toc149902327) |
| [**R4-2319305**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319305.zip) | ZTE Corporation | ***Proposal1: The performance part of LTM L1 measurement wait for more progress on core part.******Proposal 2: For subsequent-CPAC testing of PSCell change delay, define test for NR-DC with selective activation of cell groups via L3 enhancements.******Proposal 3: For subsequent-CPAC, it is proposed to define test for both FR1-FR1 NR-DC and FR1-FR2 NR-DC.******Proposal 4: The performance part of improvement on SCell/SCG setup delay wait for more progress on core part.******Proposal 5: For enhanced CHO, it is proposed to define test as follow:******-CHO with target MCG in FR1 and target SCG in FR1 in NR-DC******-CHO with target MCG in FR1 and target SCG in FR2 in NR-DC******-CHO with target MCG in FR1 and candidate SCG for CPC/CPA in FR1 in NR-DC******-CHO with target MCG in FR1 and candidate SCG for CPC/CPA in FR2 in NR-DC******Observation 1: for CHO including target MCG and candidate SCG for CPC/CPA, when CHO-only configuration is provided and CHO condition is fulfilled without CPC condition being fulfilled, the existing test case for CHO can be used.******Proposal 6: for CHO including target MCG and candidate SCG for CPC/CPA, it is proposed to define tests for the case that CHO-only configuration is not provided.*** |
| [**R4-2319375**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319375.zip) | Huawei, HiSilicon | **Proposal 1: Absolute and relative accuracy for intra-frequency and inter-frequency LTM L1-RSRP measurement are to be specified.****Proposal 2: For LTM the following test cases can be specified:*** **Test case for cell switching delay**
* **Test case for intra-frequency L1-RSRP measurement with UE capability within CP**
* **Test case for inter-frequency L1-RSRP measurement**

**Other tests are not precluded based on further conclusion of core requirements.****Proposal 3: The test case for Subsequent conditional PSCell change is to be specified.****Proposal 4: The performance part of improvement on SCell/SCG setup delay wait for more progress on core part.****Proposal 5: The following test cases can be defined:****Conditional handover including target MCG and target SCG in NR-DC*** **FR1-FR1 NR-DC to FR1-FR1 NR-DC,**
* **FR1-FR2 NR-DC to FR1-FR1 NR-DC,**
* **FR1-FR1 NR-DC to FR1-FR2 NR-DC,**
* **FR1-FR2 NR-DC to FR1-FR2 NR-DC.**

**- Conditional Handover including target MCG and candidate SCG in NR-DC*** **FR1-FR1 NR-DC to FR1-FR1 NR-DC,**
* **FR1-FR2 NR-DC to FR1-FR1 NR-DC,**
* **FR1-FR1 NR-DC to FR1-FR2 NR-DC,**
* **FR1-FR2 NR-DC to FR1-FR2 NR-DC.**
 |
| [**R4-2319630**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319630.zip) | MediaTek Inc. |  **Proposal 1: Side condition in intra-frequency L1-RSRP measurement accuracy requirements is SNR=-3dB.****Proposal 2: Reuse legacy SSB based L1-RSRP absolute and relative accuracy requirements for intra-frequency L1-RSRP measurement.****Proposal 3: Side condition in inter-frequency L1-RSRP measurement accuracy requirements is SNR=-3dB.****Proposal 4: Prefer to define both absolute and relative accuracy requirements for inter-frequency L1-RSRP measurements.****Proposal 5: Specify the test cases for*** **PCell switch delay**
* **PScell switch delay**
* **intra-frequency L1-RSRP measurement with UE incapable of RTD> CP**
* **intra-frequency L1-RSRP measurement with UE capable of RTD> CP**
* **inter-frequency L1-RSRP measurement with Type 1 MG**
* **inter-frequency L1-RSRP measurement without gap**

**Details are shown as below:**

|  |  |  |
| --- | --- | --- |
| **Core requirements defined** | **Detail**  | **Note** |
| PCell Cell switch requirements | A.6.3.x.1* RACH based Cell switch from FR1 to FR1
	+ Intra-frequency cell switch
 | Considering that the delay requirements of RACH-less cell switch is part of that of RACH based cell switch, it is enough to test RACH-less cell switch for intra-frequency cell switch only.Considering that PSCell cell switch delay is the same as PCell cell switch delay. The difference lies in interruption requirements. It is enough to only test RACH-based PSCell cell switch for intra-frequency. |
| A.6.3.x.2* RACH based Cell switch from FR1 to FR1
	+ Inter-frequency cell switch
 |
| A.6.3.x.3* RACH-less Cell switch from FR1 to FR1
	+ Intra-frequency cell switch
 |
| A.7.3.x.1* RACH based Cell switch from FR2 to FR2
	+ Intra-frequency cell switch
 |
| A.7.3.x.2* RACH based Cell switch from FR2 to FR2
	+ Inter-frequency cell switch
 |
| A.7.3.x.3* RACH-less Cell switch from FR2 to FR2
	+ Intra-frequency cell switch
 |
| PSCell cell switch | A.6.3.y.1* RACH based Cell switch from FR1 to FR1

Intra-frequency cell switch |
| A.7.3.y.1* RACH based Cell switch from FR2 to FR2
	+ Intra-frequency cell switch
 |
| UL transmit timing requirements | No need to have independent test case as can be tested in TCs for cell switch requirements |  |
| PDCCH-order RACH on neighbor cell | A.6.5.x.1* intra-frequency target cell in FR1
* RACH BW is within active BWP
 |  |
| A.6.5.x.2* inter-frequency target cell in FR1
* RACH BW is outside any configured BWP
 |
| A.7.5.x.1* intra-frequency target cell in FR2
* RACH BW is within active BWP
 |
| A.7.5.x.2* inter-frequency target cell in FR2
* RACH BW is outside any configured BWP
 |
| Intra-f L1-RSRP measurement for LTM | A.6.6.x.1* Intra-f L1-RSRP measurement in FR1
	+ RTD<CP
		- UE does not support RTD>CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells
 | UE capable of RTD>CP does not need to test the test cases for RTD<CP. A.7.6.x.3 and A.7.6.x.4 may be not needed. It depends on the conclusion on UE behavior if not claiming to support RTD>CP. |
| A.6.6.x.2* Intra-f L1-RSRP measurement in FR1
	+ RTD>CP
		- UE supports RTD>CP
		- TBD: otherwise
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells
 |
| A.7.6.x.1* Intra-f L1-RSRP measurement in FR2
	+ RTD<CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, none of neighbor cells’ TCI state activated
 |
| A.7.6.x.2* Intra-f L1-RSRP measurement in FR2
	+ RTD<CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, one of neighbor cells’ TCI state activated
 |
| [A.7.6.x.3* Intra-f L1-RSRP measurement in FR2
	+ RTD>CP and UE supports RTD>CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, none of neighbor cells’ TCI state activated]
 |
| [A.7.6.x.4* Intra-f L1-RSRP measurement in FR2
	+ RTD>CP and UE supports RTD>CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, one of neighbor cells’ TCI state activated]
 |
| Inter-f L1-RSRP measurement with Type 1 MG | A.6.6.y.1* Inter-f L1-RSRP measurement with Type 1 MG in FR1
	+ RTD<CP
	+ With known SBI
	+ 2 neighbor cells
 |  |
| A.7.6.y.1* Inter-f L1-RSRP measurement with Type 1 MG in FR2
	+ RTD<CP
	+ With known SBI
	+ 2 neighbor cells
 |  |
| Inter-f L1-RSRP measurement without gap for LTM | A.6.6.z.1* Inter-f L1-RSRP measurement without gap in FR1
	+ RTD<CP
	+ Single frequency layer
	+ 2 neighbor cells
 | As UE behavior is basically the same as L1-RSRP measurement on intra-frequency neighbor cell(s), there is no need to test all the cases.  |
| A.7.6.z.1* Inter-f L1-RSRP measurement without gap in FR2
	+ RTD<CP
	+ Single frequency layer
	+ 2 neighbor cells, none of neighbor cells’ TCI state activated
 |

**Proposal 6: No need to have independent test case for PDCCH ordered RACH, as it can be tested in the test cases for RACH-less cell switch delay.****Proposal 7: Introduce test cases with multiple configurations for subsequent Conditional PSCell Change to cover different scenarios.****Proposal 8: UEs capable of multiple DC combinations only need to test one of the test cases or one of the configurations.****Proposal 9: Define test case for solutions based on existing measurement.****Proposal 10: No need to define test cases for solutions based on enhanced measurement.****Proposal 11: Fine to define test cases or test case with multiple configurations to cover more scenarios, but UE only needs to test one of the test cases or one of the configurations if UE supports multiple NR-DC combinations.** |
| [**R4-2320622**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320622.zip) | Ericsson | [**Proposal 1:When UE is not capable of RTD > CP, if UE uses single timing for measuring neighbour cells, measurement accuracy should be studied through simulations.**](#_Toc149932037)[**Proposal 2:When different timing is assumed for measuring neighbour cells, measurement accuracy si same as legacy.**](#_Toc149932038)[**Proposal 3:Intra and Inter-frequency measurement accuracy can be assumed same.**](#_Toc149932039)[**Proposal 4:PDCCH order based RACH to neigour cell to be tested in following scenarios for delay and interruption**](#_Toc149932040)1. **Source cell is in FR1 and neighbour is in FR1**
2. **Source cell is in FR1 and neighbour is in FR2**
3. **Source cell is in FR2 and neighbour is in FR1**
4. **Source cell is in FR2 and neighbour is in FR2**

[**Proposal 5: RAN4 to deifne Test to verify prioritization of cells measurement after TCI state is activated**](#_Toc149932041)[**Proposal 6:Cell switch to neigour cell to be tested in following scenarios**](#_Toc149932042)1. **Source cell is in FR1 and neighbour is in FR1**
2. **Source cell is in FR1 and neighbour is in FR2**
3. **Source cell is in FR2 and neighbour is in FR1**
4. **Source cell is in FR2 and neighbour is in FR2**

[**Proposal 7:Interruption requirements to be tested in following scenarios**](#_Toc149932043)1. **RACH less Cell switch**
2. **RACH based cell switch**
3. **Cell switch when TCI states are pre-actviated**
4. **Cell switch when target cell is one of the serving cell**

[**Proposal 8: Using existing legecy CPC test configuration as baseline, add the second activation with 2 observation time T5 is the time when UE 2nd time send PRACH preamble and T6 is the UE receive the test system RRC\_Release message.**](#_Toc149932044)[**Proposal 9: For Solution 1 based on existing measurement results can reuse Rel-16 EMR test case as baseline with update configuration of the maximum value of both validity time and T331 timer.**](#_Toc149932045)[**Proposal 10: For Solution 2 based on enhanced measurement, the performance part can wait for more progress on the core part.**](#_Toc149932046)[**Proposal 11: Test coverage of enhanced CHO configurations shall cover both objective 3 and objective 4.**](#_Toc149932047)[**Proposal 12: For CHO+CPC objective4 test case, both CHO-only is provided and not provided shall be tested.**](#_Toc149932048) |

## Open issues summary

### Sub-topic 4-1 performance part of LTM

**Issue 4-1-1: accuracy requirements**

* Candidate solutions:
	+ Proposal 1: for intra-frequency L1-RSRP measurement, the legacy L1-RSRP accuracy requirements specified in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively can be reused at least for UE capable of RTD>CP. (CMCC)
	+ Proposal 2: it is proposed to define accuracy requirements for inter-frequency L1-RSRP measurement. (CMCC)
	+ Proposal 3: Absolute and relative accuracy for intra-frequency and inter-frequency LTM L1-RSRP measurement are to be specified. (HW, MTK)
	+ Proposal 4: Side condition in intra-frequency and inter-frequency L1-RSRP measurement accuracy requirements is SNR=-3dB. (MTK)
	+ Proposal 5: Reuse legacy SSB based L1-RSRP absolute and relative accuracy requirements for intra-frequency L1-RSRP measurement. (MTK)
	+ Proposal 6: When UE is not capable of RTD > CP, if UE uses single timing for measuring neighbour cells, measurement accuracy should be studied through simulations. When different timing is assumed for measuring neighbour cells, measurement accuracy is same as legacy. (E///)
	+ Proposal 7: Intra and Inter-frequency measurement accuracy can be assumed same. (E///)
* Recommended WF
	+ Discuss candidate solutions.

**Issue 4-1-2: test coverage**

* Candidate solutions for L1 measurement test cases:
	+ Option 1: (CATT, Nokia)
		- Test cases for intra-frequency L1-RSRP measurement
		- Test cases for inter-frequency L1-RSRP measurement
	+ Option 1a: (HW)
		- Test case for intra-frequency L1-RSRP measurement with UE capability within CP
		- Test case for inter-frequency L1-RSRP measurement
	+ Option 1c: (MTK)
		- intra-frequency L1-RSRP measurement with UE incapable of RTD> CP
		- intra-frequency L1-RSRP measurement with UE capable of RTD> CP
		- inter-frequency L1-RSRP measurement with Type 1 MG
		- inter-frequency L1-RSRP measurement without gap
* Candidate solutions for cell switch test cases:
	+ Option 1: (CATT)
		- RACH-based or RACH-less
		- Frequency range of serving cell and target cell, intra- or inter
		- Whether the target TCI state is on the active TCI state list
		- Whether the target cell is a current serving cell or not an active serving cell
	+ Option 2: (Nokia)
		- RACH-based cell switch with TCI activation+indication at cell switch command
		- RACH-based cell switch with early TCI state activation
		- RACH-less cell switch with TCI state activation+indication at cell switch command
		- RACH-less cell switch with early TCI state activation
	+ Option 3: (E///)
		- Cell switch to neigour cell to be tested in following scenarios
		- Source cell is in FR1 and neighbour is in FR1
		- Source cell is in FR1 and neighbour is in FR2
		- Source cell is in FR2 and neighbour is in FR1
		- Source cell is in FR2 and neighbour is in FR2
* Candidate solutions for PDCCH order RACH:
	+ Option 1: RAN4 to consider defining a test case for early TA acquisition based on PDCCH order separately from LTM cell switch and/or together with LTM cell switch. Details of the test case(s) are pending core part agreements. (Nokia)
	+ Option 2: PDCCH order based RACH to neigour cell to be tested in following scenarios for delay and interruption (E///)
		- Source cell is in FR1 and neighbour is in FR1
		- Source cell is in FR1 and neighbour is in FR2
		- Source cell is in FR2 and neighbour is in FR1
		- Source cell is in FR2 and neighbour is in FR2
* Candidate solutions for TCI state activation on neighbour cell:
	+ Option 1: RAN4 to deifne Test to verify prioritization of cells measurement after TCI state is activated (E///)
* Recommended WF
	+ Discuss test case coverage based on the following table provided by MTK:

|  |  |  |
| --- | --- | --- |
| **Core requirements defined** | **Detail**  | **Note** |
| PCell Cell switch requirements | A.6.3.x.1* RACH based Cell switch from FR1 to FR1
	+ Intra-frequency cell switch
 | There are totally 4 dimensions, i.e.,* RACH based or RACH-less
* FR1 or FR2
* PCell or PSCell
* Intra-f or inter-f

There can be 16 combinations, which are too many.Considering that the delay requirements of RACH-less cell switch is part of that of RACH based cell switch, it is enough to test RACH-less cell switch for intra-frequency cell switch only.Considering that PSCell cell switch delay is the same as PCell cell switch delay. The difference lies in interruption requirements, we think it is enough to only test RACH-based PSCell cell switch for intra-frequency. |
| A.6.3.x.2* RACH based Cell switch from FR1 to FR1
	+ Inter-frequency cell switch
 |
| A.6.3.x.3* RACH-less Cell switch from FR1 to FR1
	+ Intra-frequency cell switch
 |
| A.7.3.x.1* RACH based Cell switch from FR2 to FR2
	+ Intra-frequency cell switch
 |
| A.7.3.x.2* RACH based Cell switch from FR2 to FR2
	+ Inter-frequency cell switch
 |
| A.7.3.x.3* RACH-less Cell switch from FR2 to FR2
	+ Intra-frequency cell switch
 |
| PSCell cell switch | A.6.3.y.1* RACH based Cell switch from FR1 to FR1

Intra-frequency cell switch |
| A.7.3.y.1* RACH based Cell switch from FR2 to FR2
	+ Intra-frequency cell switch
 |
| UL transmit timing requirements | No need to have independent test case as can be tested in TCs for cell switch requirements |  |
| PDCCH-order RACH on neighbor cell | A.6.5.x.1* intra-frequency target cell in FR1
* RACH BW is within active BWP
 |  |
| A.6.5.x.2* inter-frequency target cell in FR1
* RACH BW is outside any configured BWP
 |
| A.7.5.x.1* intra-frequency target cell in FR2
* RACH BW is within active BWP
 |
| A.7.5.x.2* inter-frequency target cell in FR2
* RACH BW is outside any configured BWP
 |
| Intra-f L1-RSRP measurement for LTM | A.6.6.x.1* Intra-f L1-RSRP measurement in FR1
	+ RTD<CP
		- UE does not support RTD>CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells
 | UE capable of RTD>CP does not need to test the test cases for RTD<CP. A.7.6.x.3 and A.7.6.x.4 may be not needed. It depends on the conclusion on UE behavior if not claiming to support RTD>CP. |
| A.6.6.x.2* Intra-f L1-RSRP measurement in FR1
	+ RTD>CP
		- UE supports RTD>CP
		- TBD: otherwise
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells
 |
| A.7.6.x.1* Intra-f L1-RSRP measurement in FR2
	+ RTD<CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, none of neighbor cells’ TCI state activated
 |
| A.7.6.x.2* Intra-f L1-RSRP measurement in FR2
	+ RTD<CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, one of neighbor cells’ TCI state activated
 |
| [A.7.6.x.3* Intra-f L1-RSRP measurement in FR2
	+ RTD>CP and UE supports RTD>CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, none of neighbor cells’ TCI state activated]
 |
| [A.7.6.x.4* Intra-f L1-RSRP measurement in FR2
	+ RTD>CP and UE supports RTD>CP
	+ Single frequency layer
	+ 1 serving cell, 2 neighbor cells, one of neighbor cells’ TCI state activated]
 |
| Inter-f L1-RSRP measurement with Type 1 MG | A.6.6.y.1* Inter-f L1-RSRP measurement with Type 1 MG in FR1
	+ RTD<CP
	+ With known SBI
	+ 2 neighbor cells
 |  |
| A.7.6.y.1* Inter-f L1-RSRP measurement with Type 1 MG in FR2
	+ RTD<CP
	+ With known SBI
	+ 2 neighbor cells
 |  |
| Inter-f L1-RSRP measurement without gap for LTM | A.6.6.z.1* Inter-f L1-RSRP measurement without gap in FR1
	+ RTD<CP
	+ Single frequency layer
	+ 2 neighbor cells
 | As UE behavior is basically the same as L1-RSRP measurement on intra-frequency neighbor cell(s), there is no need to test all the cases.  |
| A.7.6.z.1* Inter-f L1-RSRP measurement without gap in FR2
	+ RTD<CP
	+ Single frequency layer
	+ 2 neighbor cells, none of neighbor cells’ TCI state activated
 |

### Sub-topic 4-2 performance part of NR-DC with selective activation of cell groups via L3 enhancements

**Issue 4-2-1: test coverage**

* Candidate solutions:
	+ Option 1: define the following two test cases (CATT)
		- Intra-frequency CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC)
		- Inter-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC)
	+ Option 2: define the following two test cases (Apple)
		- FR1-FR1 NR-DC to FR1-FR1 NR-DC
		- FR1-FR1 NR-DC to FR1-FR2 NR-DC (with testability issue)
	+ Option 2a: define the following two test cases (vivo)
		- Intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC
		- Inter-frequency CPC from FR1-FR1 NR-DC to FR1-FR2 NR-DC (with testability issue)
	+ Option 3: For subsequent-CPAC testing of PSCell change delay, introduce a new test case to test the delay requirement for PSCell change after a PSCell change. (Nokia)
	+ Option 4: For subsequent-CPAC, it is proposed to define test for both FR1-FR1 NR-DC and FR1-FR2 NR-DC (ZTE)
	+ Option 5: Introduce test cases with multiple configurations for subsequent Conditional PSCell Change to cover different scenarios. UEs capable of multiple DC combinations only need to test one of the test cases or one of the configurations. (MTK)
* Recommended WF
	+ Discuss candidate solutions.

**Issue 4-2-2: test configuration**

* Candidate solutions:
	+ Option 1: Using existing legecy CPC test configuration as baseline, add the second activation with 2 observation time T5 is the time when UE 2nd time send PRACH preamble and T6 is the UE receive the test system RRC\_Release message. (E///)
	+ Option 2: Test parameters in existing conditional PSCell addition can be used as baseline for subsequent Conditional PSCell Change test cases. (Apple, vivo)
* Recommended WF
	+ Discuss candidate solutions.

### Sub-topic 4-3 performance part of improvement on SCell/SCG setup delay

**Issue 4-3-1: test scope**

* Candidate solutions:
	+ Option 1: RAN4 can consider a new test case to verify the new measurement result validity procedure, e.g. use one EMR test case as baseline, and then add the newly introduced timer X. TE shall trigger measurement report after T331 expires and with X second window. (Apple)
	+ Option 2: For eEMR, define test cases for verifying measurement accuracy of UE reported idle/inactive mode measurements for the cases with and without enhanced measurements. The details of the measurements and reporting are depending on further RAN4 and RAN2 agreements. (Nokia)
	+ Option 3: Define test case for solutions based on existing measurement. No need to define test cases for solutions based on enhanced measurement. (MTK)
	+ Option 4: For Solution 1 based on existing measurement results can reuse Rel-16 EMR test case as baseline with update configuration of the maximum value of both validity time and T331 timer. For Solution 2 based on enhanced measurement, the performance part can wait for more progress on the core part. (E///)
* Recommended WF
	+ Discuss candidate solutions.

### Sub-topic 4-4 performance part of enhanced CHO configurations

#### CHO including target MCG and target SCG in NR-DC (obj.3)

**Issue 4-4-1: whether to introduce test case for CHO including target MCG and target SCG in NR-DC (obj.3).**

* Candidate solutions:
	+ Option 1: yes (CATT, vivo, CMCC, Nokia, ZTE, HW, E///)
	+ Option 2: no, given that UE anyway has to pass conditional handover test cases and handover with PSCell test cases (Apple)
* Recommended WF
	+ Agree on option 1.

**Issue 4-4-2: scope and scenario for CHO including target MCG and target SCG in NR-DC (obj.3).**

* Candidate solutions:
	+ Option 1: define test cases for both FR1+FR2 and FR1+FR1 NR-DC. (CATT, CMCC)
	+ Option 1a: (vivo, [ZTE])
		- TC1: Conditional handover with PSCell change from NR-DC to NR-DC with parallel processing (both PCell and PSCell are in FR1)
		- TC2: Conditional handover with PSCell change from NR-DC to NR-DC with sequential processing (PCell is in FR1 and PSCell is in FR2)
	+ Option 2:
		- FR1-FR1 NR-DC to FR1-FR1 NR-DC,
		- FR1-FR2 NR-DC to FR1-FR1 NR-DC,
		- FR1-FR1 NR-DC to FR1-FR2 NR-DC,
		- FR1-FR2 NR-DC to FR1-FR2 NR-DC.
	+ Option 3: Fine to define test cases or test case with multiple configurations to cover more scenarios, but UE only needs to test one of the test cases or one of the configurations if UE supports multiple NR-DC combinations. (MTK)
* Recommended WF
	+ Discuss candidate solutions.

**Issue 4-4-3: test coverage for CHO including target MCG and target SCG in NR-DC (obj.3).**

* Candidate solutions:
	+ Option 1: define test to cover both PCell handover delay and PSCell handover delay. (CMCC)
* Recommended WF
	+ Agree option 1.

#### CHO including target MCG and candidate SCG in NR-DC (obj.4)

**Issue 4-4-4: scope and scenario for CHO including target MCG and candidate SCG in NR-DC (obj.4)**

* Candidate solutions:
	+ Option 1: introduce the following two test cases (Apple, vivo, [ZTE])
		- FR1-FR1 NR-DC to FR1-FR1 NR-DC
		- FR1-FR1 NR-DC to FR1-FR2 NR-DC (with testability issue)
	+ Option 1a: define test cases for both FR1+FR2 and FR1+FR1 NR-DC. (CATT)
	+ Option 2:
		- FR1-FR1 NR-DC to FR1-FR1 NR-DC,
		- FR1-FR2 NR-DC to FR1-FR1 NR-DC,
		- FR1-FR1 NR-DC to FR1-FR2 NR-DC,
		- FR1-FR2 NR-DC to FR1-FR2 NR-DC.
	+ Option 3: Fine to define test cases or test case with multiple configurations to cover more scenarios, but UE only needs to test one of the test cases or one of the configurations if UE supports multiple NR-DC combinations. (MTK)
* Recommended WF
	+ Discuss candidate solutions.

**Issue 4-4-5: whether to define new test case for CHO with candidate PSCell for the case when CPC condition is not met and the UE proceeds with CHO-only**

* Candidate solutions:
	+ Option 1: No. RAN4 already has CHO-only test cases. (Apple, CATT, Nokia, ZTE)
	+ Option 2: Yes (CMCC, E///)
* Recommended WF
	+ Discuss candidate solutions.

**Issue 4-4-6: test configuration for CHO including target MCG and candidate SCG in NR-DC (obj.4)**

* Candidate solutions:
	+ Option 1: test parameters in test cases for conditional handover and handover with PSCell can be used as baseline for conditional handover including target MCG and candidate SCG. (CATT, Apple)
* Recommended WF
	+ Discuss candidate solutions.