**3GPP TSG-RAN WG4 Meeting # 104-e R4-22XXXXX**

**Electronic Meeting, 15– 26 August 2022**

**Agenda item:** 11.16

**Source:** Moderator (MediaTek Inc.)

**Title:** Email discussion summary for [104-e][237] NR\_Mob\_enh2

**Document for:** Information

# Introduction

This document is the email discussion summary for [104-e][237] NR\_Mob\_enh2 with the following topics covered

* Topic 1: General and work plan
* Topic 2: Study of improvement on FR2 SCell/SCG setup/resume
* Topic 3: L1/L2 based inter-cell mobility
* Topic 4: CHO/CPAC Enhancement

List of candidate target of email discussion for 1st round and 2nd round

* 1st round: Invite companies to comment in each sub-topic.
* 2nd round: TBA.

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| MediaTek Inc. | Miao WANG | Ada.wang@Mediatek.com |
| CMCC | Jingjing Chen | chenjingjing@chinamobile.com |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: General and work plan

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211550 | MediaTek Inc., Apple | **Proposal 1:** RAN4 to endorse the RRM work plan for Further NR Mobility Enhancements as presented in this contribution. |

## Open issues summary

### Sub-topic 1-1: Work plan

**Issue 1-1: Work plan proposals**

* Proposals
	+ Option 1: work plan in R4-2211550
* Recommended WF
	+ Companies are encouraged to comment on the work plan in R4-2211550 in the 1st round.

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| **Company** | **Comments** |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: Study of improvement on FR2 SCell/SCG setup/resume

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211685 | CATT | **Proposal 1:** It is suggested to reduce RX beam sweeping scaling factor to shorten the measurement delay. |
| R4-2211910 | Apple | **Observation 1**: RRC connection setup latency is much shorter than cell identification/measurement period in FR2.**Observation 2**: using fewer measurement samples can reduce measurement latency. However, measurement accuracy cannot be guaranteed. Therefore, network may not be able to rely on measurement result to configure CA/DC.**Proposal 1**: further study is needed before RAN4 confirms the feasibility of early measurement during connection setup. |
| R4-2211938 | CMCC | **Observation 1**: the existing CA/DC measurement delay requirements are so long that it is not suitable for the measurement performed during RRC connection setup/resume**Proposal 1**: it is proposed to firstly determine with which case to perform study on Rel-18 FR2 SCell/SCG setup/resume:* Case 1: UE perform CA/DC measurement closely before RRC connection setup/resume
* Case 2: UE perform CA/DC measurement during RRC connection setup/resume

**Proposal 2**: if case 2 (UE perform CA/DC measurement during RRC connection setup/resume) is considered, it is proposed to discuss the possible UE architecture to perform both CA/DC measurement and RRC connection setup/resume:* Only one RF chain is used to perform both CA/DC measurement and RRC connection setup/resume. In this way, it is inevitable that performing measurement will have impact on RRC connection setup/resume procedure.
* Two RF chains are used, one RF chain is used for SCG/Scell setup/resume, while the other RF chain is used for CA/DC measurement. In this way, CA/DC measurement and RRC connection setup/resume are performed independently, performing measurement will not have impact on RRC connection setup/resume procedure.

**Proposal 3**: if UE perform CA/DC measurement during RRC connection setup/resume, following impacts on RRM requirements are identified:* the number of samples and/or the scaling factor (N1) need to be reduced
* the requierments can not be specified based on DRX, SMTC need to be considered (DRX is not in use during RRC connection setup/resume procedure)
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| R4-2211966 | Xiaomi | **Observation 1**: If the EMR measurement results are not available or invalid, the UE initiates the improved measurement when UE requests RRC connection setup/resume.**Observation 2**: RAN4 to study the solution to reduce the improved measurement delay.**Observation 3**: RAN4 to consider the following alternatives to reduce the improved measurement delay:* Alt.1: Reduce the scaling factor of Rx beam sweeping
* Alt.2: Reduce the number of EMR carriers to be measured for improved measurement
* Alt.3: The improved measurement is based on L1-RSRP measurement
 |
| R4-2212408 | MediaTek Inc. | **Observation 1:** RRC connection setup/resume delay is too short to define any requirements for measurement during RRC connection setup/resume.**Proposal 1:** Suggest the proponents of Objective 7 to propose feasible schemes. Otherwise, objective7 should be removed from the WID. |
| R4-2212869 | Nokia, Nokia Shanghai Bell | **Observation 1:** Fast DC/CA resume/setup enables data DC/CA usage with lower latency that improves user throughput.**Observation 2:** Reduced DC/CA setup latency enhances load balancing between different cells/carrier frequencies and avoids congestion.**Observation 3:** Reduced DC/CA setup delay contributes to lower user energy consumption by reducing the data transmission time and enabling faster release of the user to idle/inactive mode. **Observation 4:** Based on RAN4 UE RRM requirement for FR2 operation assumptions, the user has one Rx panel active at a time. Additionally, the UE is allowed to sweep its receive panels/beams when performing measurements. This imposes an additional delay in FR2 compared to FR1 operation. **Observation 5:** Idle-mode FR2 inter-frequency carrier measurement requirements may take more than 2.5 minutes (which is 8 times more than that of required for FR1). **Observation 6:** Considering that the cell sizes are relatively small in FR2, 2.5 minutes measurement delay may contribute to sub-optimal DC/CA setup decision especially for mobile UEs.**Observation 7:** EMR requirements apply only when timer T331 is running. When T331 expires, it is up to the UE implementation whether to perform idle-mode DC/CA measurement, and this is only possible if the measurement configuration is provided in SIB.**Observation 8:** Inter-frequency DC/CA idle-mode measurement is supported for the users with capability of *idleInactiveNR-MeasReport-r16* when serving gNB also supports idle mode CA/DC measurement reporting and it is the validity area.**Observation 9:** Connected mode FR2 inter-carrier frequency measurement (even for one carrier frequency) may take up to **4160 msec.** **Observation 10:** Making network aware of an available FR2 cell in connected mode may take up to five times longer delay than what is required for FR1 which significantly delays FR2 DC/CA setup.**Observation 11:** Additional measurement enhancements are needed to reduce secondary link (PScell/SCell) establishment and enhance the user experience while accounting user constraints. **Observation 12:** Most of the offered load is transmitted from the PCell when SCell setup delays is long.**Observation 13:** Reduction of the CA/DC setup delay helps in providing additional resources to the UEs faster when UE is entering connected mode.**Observation 14:** With shorter setup delay we observe a reduction in UE energy consumption due to faster offload.**Observation 15:** RAN2 has defined UE actions when receiving paging for MT-originating calls or triggering RRC connection establishment/resume for MO-originating calls.**Proposal 1:** RAN4 to clarify that the “when UE has initiated access” is the point in time when RRC procedures in clauses 5.3.2.3, 5.3.3.2 or 5.3.13.2 are initiated.**Proposal 2:** Enable simultaneous use of EMR and Search threshold, i.e. UE can be requested to perform EMR even with the search thresholds.**Proposal 3:** UE can be configured to perform FR2 cell measurements during connection setup (i.e. paging, RRC connection establishment, RRC connection resume).**Proposal 4:** UE can be configured to maintain measurement configuration of previous serving cells for EMR purposes. |
| R4-2213013 | Huawei, HiSilicon | **Observation1**: It seems hard for UE to execute a complete L3 FR2 measurement during RRC connection setup/resume procedure. **Observation 2**: Due to RX beam sweeping for FR2 measurement, there is a risk that MSG2/MSG4 during RACH procedure are lost.**Proposal 1**: Suggest to further discuss the feasibility of improvement in FR2 SCell/SCG setup delay. |
| R4-2213018 | vivo | **Observation 1:** RRC connection setup delay is very short for improved measurements on FR2 SCell/SCG setup.**Proposal 1:** Further extension of the assumption on the sequence of events in FR2 SCell/SCG setup can be considered, e.g., UE initiates and performs improved measurements a bit earlier. **Proposal 2:** Further study the feasibility on only performing a quick improved measurement on the cells that have been detected/measured in early measurement. |
| R4-2213903 | Ericsson | **Proposal 1:** RAN4 shall study the potential FR2 measurement requirements enhancement based on current Early Measurement Procedure defined in Rel-16.**Proposal 2:**  RAN4 shall study the potential UE measurement enhancement that whether certain additional information or procedure can help UE to measure in a more effective way.**Proposal 3:** RAN4 shall also study what potential network/UE procedure can clarify the UE behavior with respect to the T331 timer setup with the support potential from other RAN group eg RAN2 |

## Open issues summary

### Sub-topic 2-1: Clarification and potienial direction

#### **Issue 2-1-1: Clarification on time point of “when UE has initiated access”**

* Proposals
	+ Option 1(Nokia): RAN4 to clarify that the “when UE has initiated access” is the point in time when RRC procedures in clauses 5.3.2.3, 5.3.3.2 or 5.3.13.2 (38.331) are initiated.
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | In our understanding, the intention to clarify the starting point of “when UE has initiated access” is to discuss the starting point of enhanced measurement if feasible.In our view, we can discuss issue 2-1-2 directly instead of discussing this issue. |
| CMCC | Can be discussed in Issue 2-1-2 |

#### **Issue 2-1-2: Potential direction for further study: measurement enhancement when UE is about to enter connected mode**

* Proposals
	+ Option 1(CMCC): UE perform enhanced measurement closely before RRC connection setup/resume.
	+ Option 2 (CMCC): UE perform enhanced measurement during RRC connection setup/resume.
		- Option 2a (Nokia): perform FR2 cell measurements during connection setup (i.e. paging, RRC connection establishment, RRC connection resume)
		- Option 2b (vivo): after receiving paging
		- Option 2c (vivo): after first RACH preamble transmission, i.e. Msg1
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Option 2b for MT originating calls, Option 2C for MO originating calls.For MT, the earliest time that UE knows it needs to request for RRC setup/resume is after receiving paging. The enhanced measurement (if feasible) cannot start earlier than receiving paging.For MO, UE knows it needs to request for RRC setup/resume when there is UL data to transmit. Considering the testability, the enhanced measurement (if feasible) cannot start earlier than Msg1.Anyway, we don’t think there is much difference for Option 2b and Option 2c. As stated in TS37.910 clause 5.7.2.1, the latency is only 20ms which starts from Msg1 and ends at RRC setup/resume complete. This 20ms latency is the actually latency for option2c. For option 2b, the latency is only prolonged by some uncertainty time in acquiring the first RACH occasion. The time is too short for any L3 measurement.Regarding option 1, we think it is difficult to define “closely”. |
| CMCC | For option 2, UE perform enhanced measurement during RRC connection setup/resume, it will extend the RRC connection setup/resume delay. However, when UE requests RRC connection setup/resume (no matter MT originating call or MO originating call), it is expected that UE could switch to connected mode as soon as possible, which means that RRC connection setup/resume is expected to be completed quickly. From this point of view, we are not sure whether it is a good way to improve FR2 SCell/SCG setup delay at the expense of prolong RRC connection setup/resume delay. The impact on RRC connection setup/resume procedure need to be considered. We would like to hear companies’ views on this issue.As for MTK’s comments that it is difficult to define “closely”, we would like to clarify our consideration. For MT originating call, “closely before RRC connection setup/resume” means that the measurement is performed during the period between paging reception and UE send *RRCResumeRequest/ RRCSetupRequest*. For MO originating call, “closely before RRC connection setup/resume” means that the measurement is performed after upper layers request establishment of an RRC connection and before UE send *RRCResumeRequest/ RRCSetupRequest*.The details can be further discussed. Anyway, the motivation of “closely before RRC connection setup/resume” is to avoid the impact on RRC connection setup/resume procedure and can also guarantee that the measurement results are valid when they are reported. We are open to discussion and would like see companies’ views |

#### **Issue 2-1-3: Potential direction for further study: enhancement on R16 EMR, i.e. measurement enhancement in idle/inactive mode**

* Proposals
	+ Option 1 (Nokia): Enable simultaneous use of EMR and Search threshold, i.e. UE can be requested to perform EMR even with the search thresholds.
	+ Option 2 (Ericsson): Study the potential FR2 measurement requirements enhancement based on current Early Measurement Procedure defined in Rel-16.
	+ Option 3 (Ericsson): Study what potential network/UE procedure can clarify the UE behavior with respect to the T331 timer setup with the support potential from other RAN group e.g. RAN2
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | We don’t think further enhancement on R16 EMR is in scope, as in WID it clearly states “UE initiates and performs improved measurements when it requests RRC connection setup/resume”.

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| To study the following, with completion targeted by RAN#98 meeting [RAN4]:* The impact of FR2 RRM mobility measurement acquisition and reporting on FR2 SCell/SCG setup/resume delay for a UE connecting from idle/inactive mode.
* The level of feasible improvement in FR2 SCell/SCG setup delay from defining new UE measurement procedures and RRM core requirements, and whether additional information from the network would help the UE to perform those measurements effectively. The following sequence of events should be assumed.
	+ - The UE initiates and performs improved measurements when it requests RRC connection setup/resume.
		- After acquiring those improved measurements, the UE subsequently reports those measurements to the network to support SCell/SCG setup.
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| CMCC | From requirements point of view, we observe that following updates need to be considered taking Rel-16 EMR requrements as baseline:* If the CA/DC measurement is performed during RRC connection setup/resume, the requierments can not be specified based on DRX, SMTC or SSB periodicity need to be considered (in our view, DRX is not in use during RRC connection setup/resume procedure)
* If the CA/DC measurement is performed during RRC connection setup/resume, in order to reduce the impact on RRC connection setup/resume procedure, reduced delay requirements need to be considered (existing Rel-16 EMR requrements are very long)

For the case that CA/DC measurement is performed during RRC connection setup/resume, if we want to reuse the existing Rel-16 EMR requrements (i.e. the number of samples), another way is to consider the possible UE architecture. If two RF chains are used, one RF chain is used for SCG/Scell setup/resume, while the other RF chain is used for CA/DC measurement. In this way, CA/DC measurement and RRC connection setup/resume are performed independently, performing measurement will not have impact on RRC connection setup/resume procedure.For the case that CA/DC measurement is performed closely before RRC connection setup/resume (option 1 in Issue 2-1-2), since the measurement has no impact on RRC connection setup/resume procedure, it is possible to reuse existing Rel-16 EMR requrements (i.e. the number of samples). |

#### **Issue 2-1-4: Applicable scenarios**

* Proposals
	+ Option 1(xiaomi): Scenarios that the EMR measurement results are not available or invalid
	+ Option 2 (vivo): On the cells that have been detected/measured in early measurement
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Option 1. If the EMR measurement results are available and valid, UE does not need to perform any improved measurement during RRC connection setup/resume. |

### Sub-topic 2-2: Assumptions for feasibility study

*Some companies have proposed RRC connection setup latency is too short for further measurement enhancement during RRC connection setup/resume. Moderator suggests to align some basic assumption at first and then make a comparison between RRC connection setup latency and measurement delay. The list assumptions are based on the proposed candidate solutions. Companies also are encouraged to discuss the feasibility of these solutions.*

#### **Issue 2-2-1: Assumption for feasibility study: RF chain status when performing enhanced measurement**

* Proposals
	+ Option 1 (CMCC): One active RF chain
	+ Option 2 (CMCC): Two active RF chains
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Option 2. It is reasonable to assume two active RF chains as UE is supposed to support corresponding CA/DC band combination. |
| CMCC | We are OK with option 2. With two RF chain, one RF chain is used for SCG/Scell setup/resume, while the other RF chain is used for CA/DC measurement. In this way, CA/DC measurement and RRC connection setup/resume are performed independently, performing measurement will not have impact on RRC connection setup/resume procedure. |

#### **Issue 2-2-2: Assumption for feasibility study: number of frequency layers**

* Proposals
	+ Option 1(xiaomi): Reduce the number of EMR carriers to be measured for improved measurement
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | The more frequency to measure, the longer measurement delay is. Even assuming 2 active RF chains during RRC connection setup/resume, Rx/Tx at serving cell may be interrupted if there are more than one frequency to measure due to RF retuning. Therefore it is not feasible to measure more than one frequency during RRC connection setup/resume. |

#### **Issue 2-2-3: Assumption for feasibility study: Reduced number of samples**

* Proposals
	+ Option 1(CMCC): Yes
		- Option 1a (xiaomi): based on L1-RSRP measurement
	+ Option 2(Apple): No
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Option 2. We suggest to use L3 intra-frequency measurement requirements as a baseline here, i.e. 24 samples for cell identification and 24 samples for measurement (including Rx beam sweeping factor and number of samples to average). We don’t agree to use fewer samples to average as measurement accuracy cannot be guaranteed. Regarding Rx beam sweeping factor, as all the legacy measurement requirements are defined based on single-panel assumption and simultaneous multi-panel is just in discussion in R18, we think we should stick to single-panel assumption here and keep Rx beam sweeping factor unchanged. |
| CMCC | We are open to discussion. As we discussed in Issue 2-1-3. Whether it is necessary to enhance the number of samples pending on the scenario. If the measurement has impact on RRC connection setup/resume procedure, in order to reduce the impact, it is better to enhance the number of samples. |

#### **Issue 2-2-4: Assumption for feasibility study: Reduce the scaling factor of Rx beam sweeping**

* Proposals
	+ Option 1 (CATT, CMCC, xiaomi, vivo): Yes
* Recommended WF
	+ Moderator would like the proponents to propose candidate feasible solutions to reduce scaling factor of Rx beam sweeping for further discussion.

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| **Company** | **Comments** |
| MTK | Not agree with option 1. As all the legacy measurement requirements are defined based on single-panel assumption and simultaneous multi-panel is just in discussion in R18, we think we should stick to single-panel assumption here. |
| CMCC | Option 1. In Rel-17, enhancement of scaling factor on RX beam sweeping is introduced. For FR2 HST, the value of scaling factor is 2 or 6 pending on the different deployment. In Rel-17 positioning WI, the candidate Rx beam sweep numbers for reduced Rx beam sweeping factor (<8) UE capability are {1, 2, 4, 6}. Both of the reduced RX beam sweeping factor can be considered as baseline for further discussion. |

#### **Issue 2-2-5: Assumption for feasibility study: Configuration assumption**

* Proposals
	+ Option 1(CMCC, vivo): The requirements cannot be specified based on DRX, SMTC(DRX is not in use during RRC connection setup/resume procedure)
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Fine with assuming DRX is not in use during RRC connection setup/resume. It is ok to us to use either SMTC or SSB period during feasibility evaluation. We suggest to use the typical value 20ms. |
| CMCC | In our understading, DRX is not in use during RRC connection setup/resume procedure, updates are necessary. As for to use SMTC or SSB periodicity, we are open to discuss. |

#### **Issue 2-2-6: Assumption for feasibility study: others**

* Proposals
	+ Option 1(Ericsson): Study the potential UE measurement enhancement that whether certain additional information or procedure can help UE to measure in a more effective way.
	+ Option 2 (Nokia): UE can be configured to maintain measurement configuration of previous serving cells for EMR purposes
* Recommended WF
	+ Moderator thinks it will be easier to converge if proponent of Option 1 can further clarify what additional information or procedure option 1 is referring to.
	+ Need more discussion.

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| **Company** | **Comments** |
| MTK | Regarding option 2, we think it is a method of how UE determines which frequencies to measure. This should be discussed after confirming the feasibility of improved measurement during RRC connection setup/resume. |

### Sub-topic 2-3: Feasibility discussion

*Some companies provide solid analysis to show the necessity for improvement in FR2 SCell/SCG setup delay. Moderator thinks RAN4’s work is to study the feasibility. So we only focus on feasibility discussion in this thread.*

*Some companies propose their concerns on the feasibility of improvement in FR2 SCell/SCG setup delay. Moderator encourages companies to comment on their concerns.*

#### **Issue 2-3-1: Whether RRC connection setup delay is very short for improvement on FR2 SCell/SCG setup delay**

* Proposals
	+ Option 1 (Apple, HW, MTK, vivo): Yes
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Agree with option 1. As stated in TS37.910 clause 5.7.2.1, the latency is only 20ms which starts from Msg1 and ends at RRC setup/resume complete. Even UE starts measurement after receiving paging, the latency is only prolonged by some uncertainty time in acquiring the first RACH occasion. Considering the typical SSB period is 20ms, RRC connection setup/resume delay is too short for improved measurement during RRC connection setup/resume procedure. |
| CMCC | Agree with option 1. And the impact on RRC connection setup/resume procedure also need to be considered. It is not expected to prolong the RRC connection setup/resume procedure. |

#### **Issue 2-3-2: Impact on RACH due to measurement during RRC connection setup/resume**

* Proposals
	+ Option 1 (HW): Due to RX beam sweeping for FR2 measurement, there is a risk that MSG2/MSG4 during RACH procedure are lost.
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Agree with option 1. Even assuming 2 active RF chains during RRC connection setup/resume, Msg2/3/4/5 may be impacted if there are more than one frequency to measure due to RF retuning. |

#### **Issue 2-3-3: Feasibility of improvement in FR2 SCell/SCG setup delay**

* Proposals
	+ Option 1 (Apple, HW, MTK, vivo): further discuss the feasibility of improvement in FR2 SCell/SCG setup delay
* Recommended WF
	+ Need more discussion

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| **Company** | **Comments** |
| MTK | Option 1.  |
| CMCC | Agree with option 1. |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: L1/L2 based inter-cell mobility

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2212671 | vivo | **Observation 1** From RRM perspective, to specify requirements to support R18 L1/L2 mobility, RAN4 would need consider the following extensions to R17 inter-cell L1 measurements and R17 inter-cell TCI switching* Serving cell is changed, while
	+ BWP of target cell can be either same (i.e. target cell is R17 CDP) or different from source cell.
	+ The SSB frequency of source cell and target cell can be either same or different
* The inter-cell operation can be applicable to both sync case and the async case between source cell and target cell.
* For those UEs with higher capability, further discuss whether to support L1 measurements on more than 1 candidate cells per SSB frequency layer, whose timing difference can be larger than CP per frequency layer.

**Observation 2** RAN4 would be responsible for providing the definition of ‘intra-frequency/inter-frequency’ in L1/L2 centric inter-cell operation, which is mentioned in the WID.**Proposal 1** RAN4 to start the discussion of RRM impacts of L1/L2 mobility early in R18, at least focus on the following* Define/Clarify the ‘intra-frequency/inter-frequency’ of inter-cell operation mentioned in the WID.
* Further discuss the necessity, feasibility, and pros/cons for introducing ‘inter-frequency’ L1 measurements to support R18 L1/L2 mobility.
* Further discuss the case when Rx timing difference between different candidate cells on the same frequency layer is larger than CP, is supported by UEs with higher capability in R18 or not.
 |
| R4-2213012 | Huawei, HiSilicon | **Proposal 1**: Both intra-frequency and inter-frequency L1/L2 measurement are supposed to be supported.**Proposal 2**: RAN4 would specify L1/L2 inter-cell mobility delay and each component of L1/L2 inter-cell mobility delay would be analyzed.**Proposal 3**: For R18 L1/L2 inter-cell mobility, the number of supported cells with PCI different from serving cell is supposed to be discussed.**Proposal 4**: If more than 1 non-serving cell are supported to perform L1/L2 mobility, the R17 scaling factor between serving cell L1 measurement and non-serving cells, i.e., Psc and PCDP, needs update correspondingly. |
| R4-2211686 | CATT | **Proposal 1**: RAN4 to define RRM requirements for L1/L2 based inter-cell mobility. The RRM requirements will cover all scenarios. **Proposal 2**: The main impact RRM requirements for L1/L2 based inter-cell mobility may include:* handover delay requirements/interruption requirements
* Cell change requirements
* L1 measurement and reporting requirements
* Timing management requirements

Wait for further progress from RAN2.**Observation 1**: For handover delay/interruption requirements, replace RRC commands component with L1/L2 signalling, TCI switching delay requirements can be referred.**Observation 2**: For timing management requirements, the source cell TA part can be reused. For neighbor cell, the other part can be discussed for adjustment after conclusion of the TA mechanism.  |
| R4-2211911 | Apple | **Proposal 1**: at current stage, RAN4 shall focus on feasibility study for L1/L2 based inter-cell mobility.**Proposal 2**: depending on working group, if UE needs to perform L1 measurement on inter-frequency neighbour cells, a measurement gap shall be configured. RAN4 needs to discuss feasibility of measurement gap based L1 measurement.**Observation 1**: L1/L2 based DAPS handover cannot bring significant gain on top of existing RRC based DAPS handover.**Proposal 3**: simultaneous Rx/Tx with both source cell and target cell is not considered in L1/L2 based inter-cell mobility. At least not as baseline assumption for UE to support this feature. |
| R4-2212409 | MediaTek Inc. | **Proposal 1**: We suggest to define RRM requirements assuming single panel in FR2.**Proposal 2**: We suggest to deprioritize the discussion on inter-frequency L1/L2-based inter-cell mobility.**Proposal 3**: For intra-frequency L1 measurement on neighbor cell, we can use the requirements for L1 measurement on NSC in R17 as a start point:* + single FFT assumption
	+ the timing offset of serving cell and neighbor cell is within CP
 |
| R4-2212870 | Nokia, Nokia Shanghai Bell | **Proposal 1:** RAN4 to discuss which delay component would be expected when performing an L1/L2 mobility cell change.**Observation 1:** Cell change interrupt related to a cell change by L1/L2 mobility should aim at being shorter than existing interrupt due to L3 handover to enable gains from L1/L2 mobility over existing L3 mobility.**Observation 2:** RAN4 has defined L1-RSRP measurement accuracy requirements for a cell with different PCI than serving cell.**Proposal 2:** Discuss if existing L1-RSRP measurement requirements for a cell with different PCI than serving cell can apply for L1 measurements for L1/L2 mobility.**Proposal 3:** Discuss the L1-RSRP measurement accuracies and whether they can be improved for L1/L2 mobility.**Observation 3:** Inter-frequency L1-RSRP measurement accuracy requirements on non-serving cell need to be defined. |
| R4-2213959 | Ericsson | **Proposal 1**: L1/L2 mobility shall be discussed as a new feature compared to inter-cell BM and do not consider inter-cell BM requirements as baseline for L1/L2 mobility.**Proposal 2**: UE capability of supporting multi-RX chain and simultaneous RX from different QCL type-D should be considered in L1/L2 mobility.**Proposal 3**: RAN4 to study L1-RSRP measurement on L1/L2 mobility candidate cells impact to L3 mobility measurements.**Proposal 4**: RAN4 to consider both intra-frequency and inter-frequency candidate cells for defining the requirements for L1 measurements.**Proposal 5**: RAN4 to study of the possibility to use any type of gaps for inter-frequency L1 measurements.**Proposal 6**: RAN4 to study and define the following requirements * L1/L2 mobility delay requirements
* L1/L2 mobility interruption requirements
* Measurement’s requirements and measurement accuracy requirements
* Timing requirements
	+ MRTD and MTTD
 |

## Open issues summary

### Sub-topic 3-1: RRM requirements to specify

#### **Issue 3-1-1: L1/L2 inter-cell mobility delay requirements**

* Proposals
	+ Option 1(HW, CATT, Nokia, Ericsson): To specify L1/L2 inter-cell mobility delay and each component of L1/L2 inter-cell mobility delay would be analysed.
* Recommended WF
	+ Need more discussion

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | We agree with option 1. But as the requirements are highly depending on the design in RAN2, we can start the work after RAN2 has specified concrete procedures. |
| CMCC | OK with option 1. |

#### **Issue 3-1-2: L1/L2 inter-cell mobility interruption requirements**

* Proposals
	+ Option 1(CATT, Ericsson): To specify L1/L2 inter-cell mobility interruption requirements
* Recommended WF
	+ Moderator would like to check whether the interruption requirements here are Tinterrupt in mobility delay requirements. If yes, this issue is covered by issue 3-1-1 and no more discussion on this issue.

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| **Company** | **Comments** |
| XXX |  |

#### **Issue 3-1-3: L1-RSRP measurement delay requirements**

* Proposals
	+ Option 1(CATT, Ericsson): Specify L1-RSRP measurement delay requirements
		- Option 1a (HW): If more than 1 non-serving cell are supported to perform L1/L2 mobility, the R17 scaling factor between serving cell L1 measurement and non-serving cells, i.e., Psc and PCDP, needs update correspondingly.
		- Option 1b (Ericsson): Study L1-RSRP measurement on L1/L2 mobility candidate cells impact to L3 mobility measurements.
	+ Option 2 (Nokia): Discuss if existing L1-RSRP measurement requirements for a cell with different PCI than serving cell can apply for L1 measurements for L1/L2 mobility.
* Recommended WF
	+ Need more discussion.

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| --- | --- |
| **Company** | **Comments** |
| MTK | This issue is highly pending on the outcome of issue 3-2-3/3-2-4/3-2-5/3-2-6. We suggest to discuss this issue after RAN4 has agreement on issue 3-2-3/3-2-4/3-2-5/3-2-6. |

#### **Issue 3-1-4: Timing management requirements**

* Proposals
	+ Option 1 (CATT): Specify timing management requirements
		- For timing management requirements, the source cell TA part can be reused. For neighbor cell, the other part can be discussed for adjustment after conclusion of the TA mechanism.
* Recommended WF
	+ Need more discussion.

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| **Company** | **Comments** |
| MTK | As this issue is highly depending on the design in RAN1/2, we can wait for RAN1/2 input. |

#### **Issue 3-1-5: Timing requirements**

* Proposals
	+ Option 1 (Ericsson): Specify timing requirements
		- MRTD and MTTD
* Recommended WF
	+ Need more discussion. Moderator would like the opponent to clarify whether MRTD and MTTD here refers to MRTD and MTTD between serving cell and target cell.

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| --- | --- |
| **Company** | **Comments** |
| MTK | We don’t get what MRTD and MTTD requirements and why these requirements are to be specified here. Maybe Ericsson can clarify? |

### Sub-topic 3-2: Scenarios

#### **Issue 3-2-1: Whether to consider simultaneous Rx/Tx with both source cell and target cell**

* Proposals
	+ Option 1 (Apple): No
* Recommended WF
	+ Need more discussion.

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| --- | --- |
| **Company** | **Comments** |
| MTK | Agree with option 1. In our understanding, this WID does not intend to study L1/L2 based DAPS handover. Simultaneous Rx/Tx with both source cell and target cell requires high UE complexity. In this WI, a CG can be switched. UE complexity would scale up with the number of cells in a CG if consider simultaneous Rx/Tx with both source cell and target cell. |

#### **Issue 3-2-2: Whether to consider simultaneous multi-panel in FR2**

* Proposals
	+ Option 1 (MTK): No
	+ Option 2 (Ericsson): Yes
* Recommended WF
	+ Need more discussion.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | Option 1. Since all the legacy RRM requirements are defined based on single panel assumption in FR2 and there is a R18 WI especially for multi-panel (RP-221753), the discussions on RRM requirements related to multi-panel should wait for the outcome of RP-221753. Therefore, we should focus on single panel in this WI. |

#### **Issue 3-2-3: Definition of** **intra-frequency/inter-frequency in inter-cell operation**

* Proposals
	+ Option 1(vivo): RAN4 to discuss the definition of intra-frequency/inter-frequency in inter-cell operation
* Recommended WF
	+ Need more discussion.

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| --- | --- |
| **Company** | **Comments** |
| MTK | We think the definition of intra-frequency and inter-frequency is used for L1-RSRP measurement. For SSB L1-RSRP measurement, we can follow the definition of L3 measurement. For CSI-RS L1-RSRP measurement, we think further discussion is needed on the definition after RAN1/2 and RAN4 have confirmed to use CSI-RS L1-RSRP measurement for L1/L2 inter-cell mobility. |

#### **Issue 3-2-4: Whether to cover inter-frequency**

* Proposals
	+ Option 1(MTK, vivo): Further discuss the necessity, feasibility, and pros/cons
	+ Option 2 (HW, CATT, Nokia, Ericsson): Yes
		- Option 2a (Apple): cover inter-frequency measured using measurement gap
		- Option 2b (Ericsson): Study of the possibility to use any type of gaps for inter-frequency L1 measurements
* Recommended WF
	+ Need more discussion.

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| --- | --- |
| **Company** | **Comments** |
| MTK | Option 1. For inter-frequency L1-RSRP measurement, UE is supposed to measure in MG. Measurement opportunities are shared among L1/L3 measurement. The measurement delay will be very long. The intention to use L1 measurement for L1/L2 mobility is to get the channel state change timely to switch to a better beam. Due to long measurement delay of inter-frequency, the benefit will be marginal compared to cell switch based on L3 measurement. |
| CMCC | Option 2. According to the WID, it is clearly stated that both intra-frequency and inter-frequency are included.  |

#### **Issue 3-2-5: Whether to cover non-synchronous scenarios**

* Proposals
	+ Option 1 (MTK): No
	+ Option 2 (CATT): Yes
	+ Option 3 (vivo): FFS
* Recommended WF
	+ Need more discussion.

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| --- | --- |
| **Company** | **Comments** |
| MTK | We don’t think the definition of synchronous and non-synchronous is clear now. The definition for L1-RSRP measurement and cell switch delay may be different. For L1-RSRP measurement, non-synchronous is referring to that the time offset between serving cell and to-be-measured neigbour cell is larger than CP in our understanding. |

#### **Issue 3-2-6: Whether to support L1 measurement on multiple cells with PCI different from serving cell**

* Proposals
	+ Option 1(HW, vivo): to discuss the number of supported cells with PCI different from serving cell
* Recommended WF
	+ Need more discussion.

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| --- | --- |
| **Company** | **Comments** |
| MTK | We think it is whether to support L1 measurement on multiple neighbor cells in a FR2 band to discuss. Due to CBM limitation, UE is supposed to measure different neighbor cells on the same FR2 band in a TDM way.We prefer to deprioritize multiple cells in a FR2 band. The more cells to perform L1 measurement, the more interruptions on serving cells or longer measurement delay is expected. In our understanding, NW is supposed to configure cells to perform L1 measurement based on L3 measurement results. We think it is reasonable that NW reconfigures the cell to perform L1 measurement if needed instead of asking UE to measure a bunch of cells. |

### Sub-topic 3-3: Measurement accuracy

#### **Issue 3-3-1:** **Intra-frequency L1-RSRP measurement accuracy requirements**

* Proposals
	+ Option 1 (Nokia): Discuss whether they can be improved for L1/L2 mobility
* Recommended WF
	+ Need more discussion

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| --- | --- |
| **Company** | **Comments** |
| MTK | Not agree with option 1. We don’t think this is in the scope. |

#### **Issue 3-3-2: Inter-frequency L1-RSRP measurement accuracy requirements**

* Proposals
	+ Option 1 (Nokia): Define inter-frequency L1-RSRP measurement accuracy requirements on non-serving cell
* Recommended WF
	+ Come back when we have conclusion on issue 3-2-4

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #4: CHO/CPAC Enhancement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211686 | CATT | **Proposal 3**: RAN4 to define RRM requirements for NR-DC selective activation of the cell groups requirements. Depend on RAN2/RAN3 outcomes. PSCell change and CPC requirements for EN-DC and NR-DC can be referred as start point.**Proposal 4**: RAN2 and RAN3 finished supporting CHO including target MCGs and target SCGs. RAN4 to reuse current RRM requirements for CHO including target SCG. **Proposal 5**: For CHO including target MCG and candidate SCGs for CPC/CPA in NR-DC, it depends on RAN2/RAN3 outcomes. RAN4 requirements of CHO/CPC CPA can be referred to. |
| R4-2211911 | Apple | **Observation 2**: whether candidate SCGs are considered as neighbor cells or deactivated SCGs has impact on RAN4 requirements.**Observation 3**: most of the existing CPC/CPA requirements in RAN4 can be reused to support subsequent cell group change. Some clarification/change on CPC/CPA starting point may be needed.**Proposal 4**: RAN4 shall wait for RAN2 input on procedure design of selective SCG activation and subsequent cell group change to further discuss RAN4 impact. |
| R4-2213014 | Huawei, HiSilicon | **Proposal 1**: If RAN4 would like to define delay requirements of R18 CPAC with subsequent CPC, how to the starting point of the 2nd time CPC needs further discussion. -Option 1: from UE 2nd triggering the CPC;-Option 2: using the legacy starting point and define the delay includes both the 1st time CPAC and subsequent CPC**Proposal 2**: When CHO and associated CPA are executed simultaneously, the CHO delay with PSCell may need to be specified.**Proposal 3**: Whether RAN4 needs to define requirements for non-simultaneous CHO and CPA depends on RAN2 progress. |
| R4-2213019 | vivo | **Proposal 1:** The RRM requirements of CHO and CPAC will be discussed until RAN2 has specified concrete scenarios and procedures.**Proposal 2:** For subsequent CPAC, whether there are concrete effects on the current CPAC delay requirements depend on RAN2’s conclusions. |

## Open issues summary

### Sub-topic 4-1: subsequent CPAC

**Issue 4-1-1: RRM requirements for subsequent CPAC**

* Proposals
	+ Option 1 (CATT, Apple, vivo): wait for RAN2 input to further discuss RAN4 impact.
	+ Option 2 (HW): Further discussion the starting point of the 2nd time CPC if to define RRM requirements for subsequent CPAC
* Recommended WF
	+ Moderator suggests to start the discussion when RAN2 has specified concrete scenarios and procedures.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | Option 1.  |

### Sub-topic 4-2: CHO with CPAC

**Issue 4-2-1: RRM requirements for CHO with CPAC**

* Proposals
	+ Option 1 (CATT, HW, vivo): wait for RAN2 input to further discuss RAN4 impact.
* Recommended WF
	+ Moderator suggests to start the discussion when RAN2 has specified concrete scenarios and procedures.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | Option 1. |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents