**3GPP TSG-RAN WG4 Meeting #104-e R4-221XXXX**

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

**Agenda item:** 9.6.4

**Source:** Moderator (CMCC)

**Title:** Email discussion summary for [104-e][205] NR\_HST\_FR1\_enh\_RRM

**Document for:** Information

# Introduction

This email discussion focuses on RRM for Rel-17 NR FR1 HST, and in particular the agenda items:

9.6.1 RRM core requirements maintenance

9.6.2 RRM performance requirements

The targets of email discussion for 1st round and 2nd round are:

* 1st round: focus on discussing the open issues and strive to minimize the open issues
* 2nd round: according to 1st round discussion, discuss left open issues for 2nd round, and strive to agree on the draft CRs.

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

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Nokia, Nokia Shanghai Bell | Anthony Lo | Anthony.Lo@nokia.com |
| vivo | Yanliang SUN | yanliang.sun@vivo.com |
| CATT | Yanze Fu | fuyanze@catt.cn |

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: RRM core requirements maintenance

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211930 | CMCC | CR on measurement requirements for FR1 HST |
| R4-2212415 | MediaTek inc. | Maintenance CR for Rel-17 HST in FR1 on 38.133 |
| R4-2213015 | vivo | CR on the enhancement for inter-frequency measurement in idle mode for HST |

## Open issues summary

N/A (Note: the upper bound issue of L1-SINR and SS-SINR will be discussed in Topic 2)

## 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2211930 (CMCC) | Nokia: For consistency, “highSpeedMeasInterFreq-r17” should be “*highSpeedMeasInterFreq-r17* “? |
| CATT: OK |
|  |
| R4-2212415 (MTK) | CATT: OK |
| Company B |
|  |
| R4-2213015 (vivo) | CATT: OK |
| 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 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.*

|  |  |
| --- | --- |
| **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: RRM performance requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211594 | Qualcomm, Inc. | Observation 1: TRS tracking range is unrelated to SINR measurement accuracy, since UE is not able to tune to interference signal frequency offset regardless of whether UE can track it or not.Proposal 1: SNR upper bound for L1-SINR measurement and SS-SINR measurement for inter-frequency requirement should follow R16 SS-SINR. |
| R4-2211672 | CATT | Proposal 1: Define the upper bound of the side condition for L1-SINR as 5dB. Proposal 2: For SS-SINR, the upper bound for side condition can be 5dB. |
| R4-2211673 | CATT | Draft CR on test case for inter-frequency measurement in SA for HST FR1 |
| R4-2211904 | Apple | draftCR on HST CA enhancement on deactivated SCell (EN-DC) |
| R4-2211945 | CMCC | Proposal 1: for L1-SINR measurement accuracy requirements, the upper bound of side condition is 5dB.Proppsal 2: for inter-frequency SS-SINR, the upper bound of side condition is 5dB. |
| R4-2212414 | MediaTek inc. | Observation 1: Considering the carrier frequency (2.1GHz for 15kHz and 3.6GHz for 30kHz) and UE speed (500 km/hr), the carrier frequency offset should be 1944Hz and 3333Hz.Observation 2: For the channel model in HST, it should be AWGN with 2\*Doppler shift.Observation 3: For the frequency tracking, UE is not required to perform the frequency compensation for the SS-SINR and L1-SINR measurement.Observation 4: For L1-SINR in R16 eMIMO, the average accuracy are 2.1 dB and 1.9 dB in the baseband for 15kHz and 30kHz, respectively.Proposal 1: For L1-SINR measurement in HST, the upper bound of the Ês/Iot side condition should be 5 dB.Proposal 2: For inter-frequency SS-SINR measurement in HST, the upper bound of the Ês/Iot side condition should be 5 dB. |
| R4-2212657 | vivo | Observation 1 According to demod discussion in R16 HST, since UE is mandatory to support tracking only 1 TCI state, the baseline scenario for defining requirements should be DPS 1a scenario.Observation 2 Support of frequency tracking and demodulation under R16 HST-SFN scenario is an optional UE capability according to R16 UE feature list.Observation 3 According to TS 38.101-4, 972Hz Doppler shift for SCS15kHz HST single tap is only for performance verification, and it is not meant to indicate the max Doppler shift UE needs to dealt with in real SCS15kHz HST deployment.Observation 4 According to TRS pattern, the frequency track ability of TRS is +/-1750Hz for SCS15kHz, and +/-3500Hz for SCS30kHz. Observation 5 In R16 SS-SINR accuracy evaluations for HST, no performance degradation is shown on the serving cell SS-SINR measurements if the one-tap scenario is considered, even assuming 1944Hz Doppler shift, and the impact of residual frequency error when UE passes-by RRH is trivial. Observation 6 The considered scenario in R17 is different from R16, since CSI-RSs for L1 measurements are UE-specific RSS on which UE may perform time-frequency tracking according to TRS, but SSBs for L3 measurements are cell-specific RSs for cell detection, which are measured without time-frequency finer tracking.Proposal 1 For DPS 1a scenario, if max doppler shift does not beyond TRS tracking ability, * No impact to L1-SINR measurement accuracy requirements if the measured RS is associated with active TCI of the UE in DPS 1a scenario, i.e. legacy performance requirements still apply to DPS 1a scenario.
* No accuracy requirements for L1-SINR measurements on RSs that are not associated with active TCI of the UE in DPS 1a scenario when side condition is above 5dB.

Proposal 2 For DPS 1b or HST-SFN scenario, no accuracy requirements for L1-SINR measurements when side condition is above 5dB.Proposal 3 RAN4 adopt the following text proposal for capturing the impact to L1-SINR accuracy, which is only for the case when CSI-RS based CMR is used and no dedicated IMR configuredObservation 1 According to demod discussion in R16 HST, since UE is mandatory to support tracking only 1 TCI state, the baseline scenario for defining requirements should be DPS 1a scenario.Observation 2 Support of frequency tracking and demodulation under R16 HST-SFN scenario is an optional UE capability according to R16 UE feature list.Observation 3 According to TS 38.101-4, 972Hz Doppler shift for SCS15kHz HST single tap is only for performance verification, and it is not meant to indicate the max Doppler shift UE needs to dealt with in real SCS15kHz HST deployment.Observation 4 According to TRS pattern, the frequency track ability of TRS is +/-1750Hz for SCS15kHz, and +/-3500Hz for SCS30kHz. Observation 5 In R16 SS-SINR accuracy evaluations for HST, no performance degradation is shown on the serving cell SS-SINR measurements if the one-tap scenario is considered, even assuming 1944Hz Doppler shift, and the impact of residual frequency error when UE passes-by RRH is trivial. Observation 6 The considered scenario in R17 is different from R16, since CSI-RSs for L1 measurements are UE-specific RSS on which UE may perform time-frequency tracking according to TRS, but SSBs for L3 measurements are cell-specific RSs for cell detection, which are measured without time-frequency finer tracking.Proposal 1 For DPS 1a scenario, if max doppler shift does not beyond TRS tracking ability, * No impact to L1-SINR measurement accuracy requirements if the measured RS is associated with active TCI of the UE in DPS 1a scenario, i.e. legacy performance requirements still apply to DPS 1a scenario.
* No accuracy requirements for L1-SINR measurements on RSs that are not associated with active TCI of the UE in DPS 1a scenario when side condition is above 5dB.

Proposal 2 For DPS 1b or HST-SFN scenario, no accuracy requirements for L1-SINR measurements when side condition is above 5dB.Proposal 3 RAN4 adopt the following text proposal for capturing the impact to L1-SINR accuracy, which is only for the case when CSI-RS based CMR is used and no dedicated IMR configured |
| R4-2212976 | Huawei, HiSilicon | Test case for CA: enhancement on deactivated SCell (SA) |
| R4-2213339 | Ericsson | draft CR on Inter-frequency with MG EN-DC for HST FR1 |
| R4-2213432 | Nokia, Nokia Shanghai Bell | Proposal 1: For FR1 HST scenarios, the degradation in L1-SINR accuracy should be limited to CSI-RS based CMR and no dedicated IMR configured.Proposal 2: Our preference is Option 2 (current L1-SINR measurement requirement can be reused in HST, no upper bound of side condition), but we can compromise on Option 3Proposal 3: RAN4 should determine the upper bound of the side condition based on a typical inter-frequency scenario for FR1 HST. |
| R4-2213338 | Ericsson | Proposal 1: Support Option3, differentiate L1-SINR for DPS1a, DSP1b/SFN.Proposal 2: Considering low probability of inter-cell beam interferences, upper bound applies in CMR case only. Proposal 3: Upper bound for side condition of SS-SINR is 5 dB. |

## Open issues summary

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

### Sub-topic 2-1: upper bound of side condition for L1-SINR

**Issue 2-1-1: upper bound of side condition for L1-SINR measurement accuracy**

* Proposals
	+ Option 1 (QC, CATT, CMCC, MTK): for L1-SINR measurement accuracy requirements, the upper bound of the side condition is same as R16 intra-frequency SS-SINR, which is 5dB
	+ Option 2 (vivo, Nokia, Ericsson):
		- For DPS 1a scenario, if max doppler shift does not beyond TRS tracking ability,
		- No impact to L1-SINR measurement accuracy requirements if the measured RS is associated with active TCI of the UE in DPS 1a scenario, i.e. legacy performance requirements still apply to DPS 1a scenario.
		- No accuracy requirements for L1-SINR measurements on RSs that are not associated with active TCI of the UE in DPS 1a scenario when side condition is above 5dB.
		- For DPS 1b or HST-SFN scenario, no accuracy requirements for L1-SINR measurements when side condition is above 5dB.
* Recommended WF
	+ More discussion is needed

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| **Issue 2-1-1: upper bound of side condition for L1-SINR measurement accuracy** |
| **Company** | **Comments** |
| XXX | …. |
| Nokia | Support Option 2 because it is a refinement of Option 1, which takes into consideration the key difference between L1-SINR and SS-SINR measurements.From our contribution, the L1-SINR accuracy requirements specified in 38.133 can be summarized as follows:* Type 1: CSI-RS based CMR and no dedicated IMR configured
* Type 2: SSB based CMR and dedicated IMR configured
* Type 3: CSI-RS based CMR and dedicated IMR configured

Type 1 is similar to L3 SS-SINR, which may suffer performance degradation under HST scenarios. For Types 2 and 3, it is not expected to observe similar performance degradation issues*Observation 1: For HST scenarios, performance degradation in L1-SINR accuracy is only observed for CSI-RS based CMR and no dedicated IMR configured*. |
| QC | Option 2 doesn’t align to Nokia’s observation, DPS 1a can have type 1. Besides, type 2 and 3 also have interference as part of the measurement, similar to type 1, and therefore the effect of ICI should be considered. Can Nokia clarify quantitatively why ICI has different impact on type 1 and 2/3? |
| Ericsson | We favor Option2 because it’s a compromised approach to deal with totally opposite views (with 5dB or without 5dB) which cannot converge in past several meetings, even scenario definitions in Option2 don’t appear in specification before. Our basic intent is to prevent ‘no upper boundary’, not to request relaxation from Option1. Given that, we encourage any possible compromise. |
| vivo | Support option 2. Moreover, we have the same understanding as Nokia. For the IMR based measurement, since there is no dedicated data transmission for this UE in the REs of IMR, the interference would be the real interference no matter what kind of transmission scheme is assumed, even for HST-SFN. The impact from ICI mainly happens in CMR-based SINR measurement, which is similar to the case of SS-SINR.  |
| Nokia2 | In response to QC’s comments, let us clarify Observation 1. Observation 1 states that L1-SINR accuracy degradation for Type 1 is worse than Types 2 and 3 irrespective of DPS 1a.

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| --- | --- | --- |
| CMR | IMR | L1-SINR accuracy requirements |
| CSI-RS | N/A | Type 1: CSI-RS based CMR and no dedicated IMR configured |
| SSB | NZP-IMR | Type 2: SSB based CMR and dedicated IMR configured |
| CSI-IM |
| CSI-RS | NZP-IMR | Type 3: CSI-RS based CMR and dedicated IMR configured |
| CSI-IM |

From the above table, Type 2 and 3 L1-SINR is computed as a ratio of CMR and IMR, while Type 1 L1-SINR is derived from CMR only. Based on our preliminary simulations for FR2 HST, the impact of ICI on Type 1 is greater than Types 2 and 3. We assume the same outcome for FR1 HST, but we plan to verify through simulations. Nevertheless, we encourage other companies to check as well. |
| QC | To Nokia: if the observation is irrespective to DPS type, we don’t think option2 aligns to Nokia’s observation. We also presented analysis/simulation shows the impact of ICI in general SINR estimation. It’s clear that Nokia’s simulation results are different from us, and therefore, we asked for “quantitative/analytical” explanation on different ICI impact on type 1 and 2/3, instead just numerical/simulation results. With different numerical results presented, we believe we need to go back to theory: given that we have the same channel model, ICI impact supposed to be the same across all types of measurements if they all include interference. Why Nokia’s simulation is contradict to this assumption of identical channel model/ICI in three types of measurements? |
| MTK | Option 1. It is fine to have 5dB upper bound for “CSI-RS based CMR and no dedicated IMR configured” only. But we prefer to define general requirements applicable to all the possible transmission scheme. |

### Sub-topic 2-2: upper bound for inter-frequency SS-SINR

**Issue 2-2-1: upper bound of side condition for inter-frequency SS-SINR measurement accuracy**

* Proposals
	+ Option 1 (QC, CATT, CMCC, MTK): for inter-frequency SS-SINR measurement accuracy requirements, the upper bound of the side condition is same as R16 intra-frequency SS-SINR, which is 5dB
	+ Option 2 (Nokia): determine the upper bound of the side condition based on a typical inter-frequency scenario for FR1 HST
* Recommended WF
	+ To move forward, moderator would like to check with companies whether option 1 is agreeable?

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| **Issue 2-2-1: upper bound of side condition for inter-frequency SS-SINR measurement accuracy** |
| **Company** | **Comments** |
| XXX | …. |
| Nokia | Option 2 does not contradict Option 1. The rationale behind Option 2 is to understand/analyze the 5 dB proposal in Option 1. Thus, we seek input from operators about their typical inter-frequency deployment scenarios. |
| QC | Option 1, it’s not obvious what option 2 differs from option 1, we suggest to agree with option 1 directly as it’s clear. |
| Ericsson | We support Option1, but we also accept if proponents of Option2 believe the number of upper bound shall be checked.And detailed wording may reply on outcome of Issue 2-1-1. |
| Huawei | Option 1 as SS-SINR in r17 HST is the same as that in R16 HST. Option 2 is not clear to us how to capture in spec. |
| vivo | Option 1 seems to be better in our understanding.In R17, the inter-frequency measurement can be used for CA. In this case, the deployment scenario of SSB can also be SFN-like. We do not expect different deployment between different CCs. The same issue as R16 may happen. |
| CATT | Support option 1. Option 2 is not clear.  |
| MTK | Option 1. As the upper bound applies to any FR1 bands, it is rational to use the same upper bound as intra-frequency. |

## 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** |
| R4-2211673 (CATT) |  Nokia: Doppler shifts seem to be missing in Cell 2 in the propagation condition |
|  QC: We suggest to move DRx configuration to common configuration section. And could CATT share the derivation of test requirement 2240 ms? And should we use A.6.6.2.2 as reference test to have two options of gap pattern? |
| CATT: To QC, what do you mean move DRX to common configuration section? DRX.4 is in the general test parameter as A.6.6.2.2. According to WF in last meeting, only MGRP = 40ms is defined. So we just define one gap pattern for TC.* Define test for inter-frequency measurement enhancement as following:

|  |  |  |
| --- | --- | --- |
|  | **Test cases** | **Test parameters** |
| #1 | A.6.1.1.X Cell reselection to FR1 inter-frequency NR case for UE configured with highSpeedMeasInterFreq-r17 | * DRX cycle: 320ms
* SMTC period: 20ms
 |
| #2 | A.6.6.2.X1 Inter-frequency with MG: SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used for UE configured with highSpeedMeasInterFreq-r17 | * DRX cycle: 160ms
* SMTC period: 20ms
* MGRP: 40ms
* MGL: 6ms
 |
| #3 | A.4.6.2.X Inter-frequency with MG: EN-DC event triggered reporting tests for FR1 without SSB time index detection when DRX is used for UE configured with highSpeedMeasInterFreq-r17 | * DRX cycle: 160ms
* SMTC period: 20ms
* MGRP: 40ms
* MGL: 6ms
 |

DRX.4: DRX cycle = 160ms; SMTC period = 20ms; MGRP = 40ms2240ms=(7x1x160)+(7x1x160) |
| R4-2211904 (Apple) |  Nokia: Doppler shifts seem to be missing in Cell 3 in the propagation condition |
| QC: minor typo: “DRX is not used” should be removed. Also, could you share how  |
| MTK: * During T1, cell3 is a deactivated SCell, but its RSRP is –infinity. We think it is not a typical scenario that deactivated SCell is not detectable.
* “Time offset between PCell and deactivated SCell” in Table A.4.6.1.X.1-2 should be “Time offset between PSCell and deactivated SCell” and the value is 3us?
 |
| R4-2212976 (Huawei, Hisilicon) | CATT: Could you please share how to get 5120ms? It is different from our calculation. We use 3200+1280 ms, is it right? |
| MTK: The measurement delay should be 5760ms (DRX= 320ms, 5 sample for PSS/SSS detection, 4 sample for measurement period, 640ms (meascycleSCell)\*9=5760ms). Besides, we suggest to use a smaller meascycleSCell, e.g. 160ms and T2 can be 3s, measurement delay=2860ms. |
|  |
| R4-2213339 (Ericsson) |  Nokia: Doppler shifts seem to be missing in Cell 3 in the propagation condition |
| QC: could you share how 2520ms in the requirement is derived? |
| Ericsson: The ratio of measurement between HST/non-HTS=7/( 8\*1.5), we multiply the ratio with existing 1080ms in A.6.6.2.2 and consider the ratio of DRX 160ms/40ms to get 2520ms. Please correct me if there is a better calculation. |
|  | Huawei: affected Test specifications is missing in coversheet.CATT: We think 2520ms is incorrect. we don’t think it can use ratio directly because in legacy test, lower bound 600ms is used. But in HST TC, which the second part of MAX function is used. In addition, we think CMCC’s CR (R4-2211930) but not latest spec since the fomular has issue in this case.  |

## 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 |  |
|  |  |  |  |  |  |
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Notes:

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

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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