**3GPP TSG-RAN WG4 Meeting # 99-e R4-210xxxx**

**Electronic Meeting, May. 19-27, 2021**

**Agenda item:** 9.7.2

**Source:** Moderator (CMCC)

**Title:** Email discussion summary for [99-e] [222] 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:

9.7.2 RRM core requirements

9.7.2.1 UE RRM core requirements for CA scenario

9.7.2.1.1General

9.7.2.1.2 Intra-frequency measurements

9.7.2.1.3 Inter-frequency measurements

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 minimize the open issues.

# Topic #1: intra-frequency measurements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109062**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109062.zip) | CATT | **Proposal 1: Add additional note can be added in Table 9.2.5.1-1, Table 9.2.5.1-3, Table 9.2.5.2-5, Table 9.2.6.2-1, Table 9.2.6.2-3, Table 9.2.6.3-3 as “NOTE: When RRM enhancement for high speed is configured for CA, the requirements apply to measurements of a secondary component carrier with active SCell.”****Proposal 2: For deactivated SCell, reuse similar principle as Rel-16 HST and add additional note for SCells in such requirements.****Proposal 3: For deactivated SCell Kp issue, it is reasonable to keep Kp. But it’s better to conclude Kp for non-HST firstly.** |
| [**R4-2109248**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109248.zip) | Xiaomi | **Proposal 1：It is proposed not to enhance the NSCC\_SSB in R17 HST WI.****Proposal 2：Kp requirements modifications shall be discussed in R17 HST after the corresponding issue concluded in R15 and R16.** |
| [**R4-2109316**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109316.zip) | Apple | **Proposal 1: enhancement on NSCC\_SSB for high speed scenario implies change in measurement strategy, which is not necessary since measurement on deactivated SCC is being enhanced in terms of adding new scaling factor M2, Y and so on.****Proposal 2: Kp is needed for deactivated SCC measurement.****Proposal 3: to avoid duplicated discussion, Kp issue can be discussed in R15 maintenance. Some conclusion can apply here for R17 FR1 HST enhancement.** |
| [**R4-2109516**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109516.zip) | CMCC | *Observation 1: based on RAN4 common understanding on the current non-HST specification, For CSSFoutside\_gap,i, both SCell(s) measured without MG and SCell(s) measured with MG are counted in NSCC\_SSB.**Observation 2: there is over counted issue on the SCell(s) measured with MG, which are calculated in both CSSFwithin\_gap,i and CSSFoutside\_gap,i**Observation 3: high speed train scenario will support the high velocity up to 500km/h, which is more sensitive to the measurement delay. The unnecessary delay introduced by over counted issue on NSCC\_SSB for the calculation of CSSFoutside\_gap,i need to be updated/revised in order to improve the measurement performance.****Proposal 1: for high speed train scenario, it is proposed that only SCell(s) measured without MG are counted in NSCC\_SSB for the calculation of CSSFoutside\_gap,i.*** |
| [**R4-2109634**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109634.zip) | MediaTek inc. | **Proposal 1: Scaling factor Kp should be introduced in PSS/SSS detection, time index detection and measurement requirement for deactivated SCells in HST and non-HST.** |
| [**R4-2110220**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110220.zip) | Ericsson | ***Proposal 1: L1-SINR was introduced in Rel-16 eMIMO, we should wait conclusion in Rel-16 HST. We’re OK to use Ês/Iot ≤5 dB from SS-SINR in L1-SINR for CMR case.*** |

## Open issues summary

### Sub-topic 1-1 NSCC\_SSB for CSSFoutside\_gap,i

**Issue 1-1: NSCC\_SSB for CSSFoutside\_gap,i**

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| --- |
| **Background (R4-2105793):*** + Enhancement on CSSFoutside\_gap,i for SCell measurement
		- RAN4 has the following common understanding of the current non-HST specification:
			* For CSSFoutside\_gap,i, both SCell(s) measured without MG and SCell(s) measured with MG are counted in NSCC\_SSB.
				+ Both activated and deactivated SCells are included
		- FFS the enhancement on NSCC\_SSB for high speed scenario
 |

* Proposals
	+ Option 1 (Nokia): NSCC\_SSB enhancements should cover non-HST as well as HST
	+ Option 2 (vivo): Further discuss the issue of CSSFoutside\_gap issue under TEI16
	+ Option 3 (Xiaomi): It is proposed not to enhance the NSCC\_SSB in R17 HST WI
	+ Option 4 (Apple): enhancement on NSCC\_SSB for high speed scenario implies change in measurement strategy, which is not necessary since measurement on deactivated SCC is being enhanced in terms of adding new scaling factor M2, Y and so on
	+ Option 5 (CMCC): for high speed train scenario, it is proposed that only SCell(s) measured without MG are counted in NSCC\_SSB for the calculation of CSSFoutside\_gap,i
* Recommended WF
	+ More discussion is needed

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| **Issue 1-1: NSCC\_SSB for CSSFoutside\_gap,i** |
| **Company** | **Comments** |
| XXX |  |
| Huawei | Share the similar view with option 4 and option 5. Changing the CSSF table will impact implementation strategy. |
| MediaTek | Support option 5.For non-HST scenario, we are open to discuss but our thinking is that it should be discussed in other WI.  |
| QC | We believe this change should be considered as a correction instead of enhancement. CSSF is calculated based on sharing of searcher across different measurement objects, and enhancement in CSSF implies different searcher implementation strategy and constraint. If RAN4 concluded that this is a correction, it should applies to both non-HST and HST.QC |
| Nokia | This is not an issue specifically for HST. The same enhancement should be applied to both HST and non-HST requirements, ensuring no ambiguity in the specification. For Option 5, could the proponent elaborate on what the implication to the specification is?  |
| Ericsson | Support option 3 and option 4.For our understanding, it should be a common question needs agreement from R16 firstly.In this sense, we don’t support option5 and the issues can be left to R16 session as option 2 points. |
| Apple | We prefer to have unified NSCC\_SSB design for both HST and non-HST. Intention is to simplify the measurement algorithm design.  |
| Xiaomi | Support Option 3 and 4. Since this issue is not exclusive to HST scenario, we prefer to solve it in R16 firstly. |
| CMCC | Our consideration is that there is unnecessary redundant calculation on SCell(s) measured without MG for NSCC\_SSB, which at least need be solved for HST since it is more sensitive to the delay. But we are also fine to solve this issue for both HST and non-HST.To Nokia, if we go with option 5, the implication to the specification is probably to add a note “when HST flag is configured, NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG” |
| vivo | We are ok for option 3 and 4. We think RAN4 can move forward with at least option 3 and 4. Moreover, we also support option 1. Quite many companies see this issue and is positive in solving this issue.If RAN4 can agree on option 1, then we see option 2 can be one solution for this issue. Please check our companion paper R4-2111257 and R4-2111259, which are separately discussed in Topic#4 of thread [241] and Topic #6 of [204]. Of course, we are open to here other solutions based on option 1. |

### Sub-topic 1-2 Kp

**Issue 1-2: Kp for deactivated Scell measurement**

* Proposals
	+ Option 1 (QC, HW, Apple, MTK): Kp shall also apply for measurement requirements on deactivated SCell in R17 FR1 HST, where Kp = 1/(1- (SMTC period /MGRP))
	+ Option 2 (Ericsson, Xiaomi): Kp requirements modifications shall be discussed in R17 HST after the corresponding issue concluded in R15 and R16
	+ Option 3 (vivo, CATT, Apple): Rel-15/Rel-16 Kp requirements modification (if any) shall also apply for R17 HST
* Recommended WF
	+ To avoid duplicated discussion, could we agree that Kp requirements modifications will be discussed in R17 HST after the corresponding issue concluded in R15/R16.

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| **Issue 1-2: Kp for deactivated Scell measurement**  |
| **Company** | **Comments** |
| Huawei | Support option 1. The issue has been discussed for three meetings. The enhancement on deactivated SCell in R17 HST WI shall be based on correct requirements. Kp modification shall also apply for R17 HST to keep consistence. |
| OPPO | Option 1 is fine. The principles of other options are also agreeable. If Rel-15/16 Kp was modified, then it should apply for Rel17 HST as well. |
| MediaTek | Support Option 1, 2 and 3. Because, in our understanding, the measurement requirement for deactivated SCell should not be tighter than activated SCell. Thus, the Kp should be considered for deactivated SCell. We can wait for the conclusion in R15/16. |
| QC | Support option 1. If companies have concern for consistency with R15, we can add a note such as “revisit if RAN4 decided not to fix R15 requirement”. |
| Nokia | Options 2 and 3 seem to similar; both options 2 and 3 are OK. |
| Ericsson | Agree with Recommended WF, Kp requirements modifications will be discussed in R17 HST after the corresponding issue concluded in R15/R16. |
| Apple | Support option 1. We are fine to come back in 2nd round in case there is agreement in R15/R16 maintenance. |
| Xiaomi | Support the Recommended WF |
| CATT | Support the recommended WF. |
| CMCC | OK with the WF. Prefer to wait the conclusion in R15/R16 maintenance. |
| vivo | OK with the WF. Moreover, we do not see significant difference between these 3 options. Regarding QC’s comments, in our view backward compatibility to R15/16 should be guaranteed at least. Therefore, it is better to keep consistency. |

## 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** |
| 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 #1-1 NSCC\_SSB for CSSFoutside\_gap,i** | **Issue 1-1: NSCC\_SSB for CSSFoutside\_gap,i***Candidate options:** Option 1(Nokia, Xiaomi, CMCC, vivo, QC, Ericsson, Apple): NSCC\_SSB clarification/correction should cover non-HST as well as HST, i.e. unified NSCC\_SSB design for both HST and non-HST
* Option 2 (CMCC, MTK): for high speed train scenario, it is proposed to clarify that only SCell(s) measured without MG are counted in NSCC\_SSB for the calculation of CSSFoutside\_gap,i
* Option 3 (HW): keep NSCC\_SSB as it is in the spec

*Recommendations for 2nd round:*Continue the discussion |
| **Sub-topic #1-2 Kp** | **Issue 1-2: Kp for deactivated Scell measurement** *Candidate options:** Option 1 (HW, OPPO, MTK, QC, Apple,): Kp shall also apply for measurement requirements on deactivated SCell in R17 FR1 HST, where Kp = 1/(1- (SMTC period /MGRP))
* Option 2 (OPPO, MTK, Nokia, Ericsson, Apple, Xiaomi, CATT, CMCC, vivo): wait for the conclusion in R15/R16 related discussion

*Recommendations for 2nd round:*Since this issue is under discussion in Rel-15/16 maintenance, to avoid duplicated discussion, suggest not to further discuss this issue in 2nd round. We can come back next meeting based on the agreement in Rel-15/16 maintenance in this meeting. |

### 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)

### Sub-topic 1-1 NSCC\_SSB for CSSFoutside\_gap,i

**Issue 1-1: NSCC\_SSB for CSSFoutside\_gap,i**

*Candidate options:*

* Option 1(Nokia, Xiaomi, CMCC, vivo, QC, Ericsson, Apple): NSCC\_SSB clarification/correction should cover non-HST as well as HST, i.e. unified NSCC\_SSB design for both HST and non-HST
	+ Option 1a: Solve this issue in R15 RRM maintenance
	+ Option 1b: Solve this issue in R16 RRM maintenance. Note that UE capability is needed to ensure backward compatibility to R15 specs.
	+ Other options are not precluded.
* Option 2 (CMCC, MTK): for high speed train scenario, it is proposed to clarify that only SCell(s) measured without MG are counted in NSCC\_SSB for the calculation of CSSFoutside\_gap,i
* Option 3 (HW): keep NSCC\_SSB as it is in the spec

*Recommendations WF:*

* Continue the discussion

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| **Issue 1-1: NSCC\_SSB for CSSFoutside\_gap,i** |
| **Company** | **Comments** |
| vivo | Support option 1. As discussed in our paper, option 2 will be strange because this NSCC\_SSB can be applied in both FR1 and FR2, and UE may not differentiate the values for different scenarios according to the SIB configuration. We have submitted draft CR to R16, but according to discussion in Thread [204] and Thread [241], companies do not prefer the approach to introduce capability signaling for this issue. Therefore, we see another promising approach is to revise this NSCC\_SSB directly in R15. According to the status of 1-1-1 and 1-1-2 in Thread [201], we think the arguments on NBC issue for this case is not that strong.Based on above comments, we further provide to options under option 1 and encourage companies to provide views. |
| Apple | We continue supporting option 1. On top of the justification we provided in the 1st round, we believe it is unlikely that NW would configure large number of SCCs for the UE, wherein some of them are measured within gap while others are measured outside gap. Therefore, updating NSCC\_SSB may not be the most critical direction to enhance measurement on SCC. On the other hand, it has impact on UE measurement strategy, we are negative on option 2. Regarding new sub-options from vivo, we think it is quite late to further update R15 spec since R15 implementation is already in the field without significant negative impact identified.We also prefer not to introduce new UE capability in R16 unless it is identified as really critical. Measurement period requirements are defined based on the worst case. It doesn’t preclude UE from doing measurement faster. Therefore, we don’t see the necessity of this new UE capability |
| MediaTek | Support 2. In our understanding, non-HST should be solved in other WI. But, at least we can enhance the NSSC\_SSB for HST in this WI in this stage. |

# Topic #2: inter-frequency measurements

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

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109063**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109063.zip) | CATT | **Proposal 1: Enhancements for RRC IDLE are needed for inter-frequency measurements. The intra-frequency for Rel-16 HST enhancement can be used as a baseline. The decreased number of samples and Kcarrier should be considered as well.****Proposal 2: Enhancements for RRC\_CONNECTED are needed for inter-frequency measurements. M2 defined in Rel-16 HST is reused. The requirements can be set as Table 1~Table 6.****Table 1: Time period for PSS/SSS detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

**Table 2: Time period for time index detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

**Table 3: Measurement period for inter-frequency measurements with gaps (Frequency FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 160ms | Max(200ms, Ceil(8 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms < DRX cycle≤ 320ms | Max(200ms, Ceil(7 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

Without measurement gaps:Table 4: Time period for PSS/SSS detection, (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(5 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

Table 5: Time period for time index detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Ceil(3 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

Table 6: Measurement period for inter-frequency measurements with gaps ((FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra  |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(M2x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| 160ms < DRX cycle≤ 320ms | max(200ms, ceil(M2x 4 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil( 5 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

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| [**R4-2109249**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109249.zip) | Xiaomi | **Proposal 1: For inter-frequency measurement without MG, the same enhancement for intra-frequency measurement without MG in R16 HST could be reused.****Proposal 2: For inter-frequency measurement with MG, the enhanced strategy for E-UTRAN TDD/FDD – NR measurements in R16 HST could be used as baseline.****Proposal 3: RAN4 to define the idle mode inter-frequency measurement enhancements for R17 FR1 HST.****Proposal 4: The R16 enhanced EUTRA-NR inter-RAT measurement requirements in idle mode could be reused for NR inter-frequency measurements.** |
| [**R4-2109317**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109317.zip) | Apple | **Proposal 1: NW shall indicate which inter-frequency layers need to be measured more often, for which enhanced inter-frequency measurement requirements shall apply.****Proposal 2: enhancement on inter-frequency measurement in connected mode can be:****Table 9.3.4-1: Time period for PSS/SSS detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, [6] × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil([6]\*M2NOTE 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | [6] × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [*highSpeedMeasFlag-r17*] is not configured, M2 = 1.5; When [*highSpeedMeasFlag-r17*] is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Table 9.3.4-3: Time period for time index detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2NOTE 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [*highSpeedMeasFlag-r17*] is not configured, M2 = 1.5; When [*highSpeedMeasFlag-r17*] is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Table 9.3.5-1: Measurement period for inter-frequency measurements with gaps (Frequency FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, [6] × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil([6] × M2NOTE 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | [6] × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [*highSpeedMeasFlag-r17*] is not configured, M2 = 1.5; When [*highSpeedMeasFlag-r17*] is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Observation 1: no significant degradation is observed if idle mode inter-frequency requirements are not enhanced.****Proposal 3: enhancement on idle mode inter-frequency is unnecessary.** |
| [**R4-2109515**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109515.zip) | CMCC | ***Proposal 1: for connected state inter-frequency measurement without MG, it is proposed to reuse intra-frequency measurement enhancement for HST, and the details are shown as following:**** ***for PSS/SSS detection delay requirements, M2 is reused***
* ***for time index detection delay requirements, M2 is reused***
* ***for measurement, M2 and Y is reused***

Measurement period for inter-frequency measurements without gaps ((FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra  |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(M2 Note 2 x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil(Y Note 3 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 3: Y= 3 when SMTC <= 40ms, Y= 5 when SMTC > 40ms |

***Proposal 2: for connected state inter-frequency measurement with MG, it is proposed to take intra-frequency measurement enhancement for HST as baseline, and the details are shown as following:**** ***for PSS/SSS detection delay requirements, M2 is reused***
* ***for time index detection delay requirements, M2 is reused***
* ***for measurement, M2 is reused, Y is introduced and the value of Y can be further discussed***

**Measurement period for inter-frequency measurements with gaps (Frequency FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms <DRX cycle ≤ 320ms | Max(200ms, Ceil([4] × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y1= [3] when SMTC <= 40ms, Y1= [8] when SMTC > 40ms |

***Proposal 3: it is proposed to define enhancement on RRC IDLE state inter-frequency measurement.******Proposal 4: the enhancement specified for intra-frequency enhancement in Rel-16 HST WI can be used as baseline to specify the enhanced requirements for inter-frequency measurement in idle mode.******Proposal 5: it is proposed to introduce a new UE capability to indicate whether the inter-frequency measurement enhancement with velocity up to 500 km/h is supported or not.******Proposal 6: If it is agreed to introduce UE capability for HST CA, it is necessary to discuss whether a single UE capability can cover both CA enhancement and inter-frequency measurement enhancement.*** |
| [**R4-2109635**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109635.zip) | MediaTek inc. | **Proposal 1: In CONNECTED mode, the inter-frequency measurements with MGs for Rel-17 HST may follow the similar logic as the R16 HST inter-RAT measurement (from LTE to NR) defined in clause 8.1.2.4.21 of TS 36.133, i.e., introduce the scaling factor M2, to define the requirement.****Proposal 2: In CONNECTED mode, for the inter-frequency measurements with MGs in Rel-17 HST, the TPSS/SSS\_sync\_inter should be:**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\* M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Proposal 3: In CONNECTED mode, for the inter-frequency measurements with MGs in Rel-17 HST, the TSSB\_time\_index\_inter should be:**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Proposal 4: In CONNECTED mode, for the inter-frequency measurements with MGs in Rel-17 HST, the TSSB\_measurement\_period\_inter** **should be:**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Proposal 5: In CONNECTED mode, the inter-frequency measurements without MGs for Rel-17 HST may follow the same logic as the R16 HST intra-frequency measurement, i.e., introduce the scaling factor M2 and Y, to define the requirement.****Proposal 6: In CONNECTED mode, for the inter-frequency measurements without MGs in Rel-17 HST, the TPSS/SSS\_sync\_inter should be:**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2 Note 2 x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(5 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Proposal 7: In CONNECTED mode, for the inter-frequency measurements without MGs in Rel-17 HST, the TSSB\_time\_index\_inter should be:**

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 Note 2 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Ceil(3 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

**Proposal 8: In CONNECTED mode, for the inter-frequency measurements without MGs in Rel-17 HST, the TSSB\_measurement\_period\_inter** **should be:**

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter  |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(M2 Note 2 x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| 160ms < DRX cycle≤ 320ms | ceil(M2 Note 2 x 4 x Kp) x max(SMTC period,DRX cycle))x CSSFinter |
| DRX cycle>320ms | ceil(Y Note 3 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 3: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

**Proposal 9: In IDLE mode, the inter-frequency measurements should be up to UE capability.****Proposal 10: In IDLE mode, the inter-frequency measurements for Rel-17 HST may follow the similar logic as the R16 HST inter-RAT measurement (from LTE to NR) defined in clause 4.2.2.5.6 of TS 36.133, i.e., introduce the scaling factor M2, M3 and M4, to define the requirement.****Proposal 11: In IDLE mode, for the inter-frequency measurements in Rel-17 HST, the Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter should be:**

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter [s] (number of DRX cycles) |
|  |
| 0.32 | 4.16 x M2 (13 x M2)Note 1 | 0.64 x M3 (2 x M3)Note 1 | 0.96 x M4 (3 x M4) Note 1 |  |
| 0.64 | 7.68 (12)) | 1.28 (2) | 1.92 (3) |  |
| 1.28 | 12.8(10)  | 1.28 (1) | 3.84 (3) |  |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |  |
| Note 1: M2=1.5, M3=2 and M4=2 if SMTC periodicity of measured intra-frequency cell > 40 ms; otherwise M2=M2=M3=1. |  |

 |
| [**R4-2110219**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110219.zip) | Ericsson | ***Proposal 1:*** ***RRC IDLE inter-frequency measurements are needed. As the case exists, enhancement is needed same as R16 for Intra-frequency measurements.*** |
| [**R4-2111256**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111256.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1: For HST, the inter-frequency measurements in connected mode are enhanced according to Tables 1-3.** **Table 1: Time period for PSS/SSS detection (Frequency range FR1) for HST**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, N Note 4 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(N Note 4\* M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | N Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.NOTE 4: When *highSpeedMeasFlag-r16* is not configured, N = 8; otherwise N = 5. |

**Table 2: Time period for time index detection (Frequency range FR1) for HST**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2 Note 3 ) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1 |

**Table 3: Measurement period for inter-frequency measurements with gaps (Frequency FR1) for HST**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 5 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(5 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160 ms ≤DRX cycle ≤ 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| DRX cycle > 320ms |  Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

*Observation* 1: It is not clear whether idle mode inter-frequency measurements are needed, considering it increases battery energy consumption of UE. |

## Open issues summary

|  |
| --- |
| **Background (R4-2105793):*** Inter-frequency measurement
	+ Define RRC Connected state inter-frequency measurement enhancements
		- Support of HST inter-frequency measurement enhancements is up to UE capability. Details are FFS
	+ FFS whether enhancements for RRC IDLE inter-frequency measurements are needed
 |

### Sub-topic 2-1: inter-frequency measurement in idle state

**Issue 2-1: whether define the enhancement for inter-frequency measurement in idle mode for HST**

* Proposals
	+ Option 1 (QC, vivo, CATT, CMCC, Xiaomi, Ericsson): Yes
	+ Option 2 (Apple): No
	+ Option 3 (MTK): up to UE capability
* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 2-1: whether define the enhancement for inter-frequency measurement in idle mode for HST** |
| **Company** | **Comments** |
| Huawei | Slightly prefer option1 to have a completed resolution in HST |
| OPPO | Option 1 is fine, since inter-frequency measurement has been agreed. Furthermore, inter-frequency measurement in idle mode is a valid case regarding operator’s demands. Both RRC idle and connected mode can be supported.  |
| MediaTek | Support Option 2 unless we have an confirmation from operator to clarify the corresponding deployment. After we check internally, we realize that UE capability may not be a good choice for IDLE mode.  |
| QC | Support option 1, for completeness HST enhancement which can benefit current or future deployment. |
| Nokia | Option 2 is preferred because it is not clear whether idle mode inter-frequency measurements are needed, considering it increases battery energy consumption of UE |
| Ericsson | Support option1. PDCCH paging can cover more than one cell. But some occasional cases need enhancement also, e.g. TAU, region change and quicker change from idle mode to connected mode. |
| Apple | As mentioned in our contribution. Enhancement in idle mode is not that critical as that in connected mode. We prefer not to enhance it since we cannot have obvious gain at the price of more UE power consumption. We can compromise to option 3a:Option 3a: introduce a dedicated UE capability indicating the support of inter-frequency measurement in idle mode for HST |
| Xiaomi | Support Option 1. |
| CATT | Support option 1.  |
| CMCC | Option 1. It is very possible deployment that different frequencies are deployed along the railway. It is necessary to specify the enhancement for idle mode.  |
| vivo | Option 1. We see it is reasonable for the operator to consider inter-frequency in IDLE mode. Moreover, it is strange UE implementation if only inter-RAT enhancement is specified. However, given the progress in the R16 feature list discussion, we are ok to list UE capability as one FFS issue. |

**Issue 2-2: if the answer to issue 2-1 is Yes, how to perform the enhancement for inter-frequency measurement in idle mode for HST**

* Proposals
	+ Option 1 (QC, CATT, CMCC, Ericsson): using the same requirement as for intra-frequency measurement for HST

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter[s] (number of DRX cycles) |
|  |
| 0.32 | 2.56 x M2 (8 x M2) | 0.32 x M3 (1 x M3) | 0.96 x M4 (3 x M4) |  |
| 0.64 | 5.12 (8) | 0.64 (1) | 1.92 (3) |  |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |  |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |  |
| Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 |  |

* + Option 2 (Xiaomi, MTK): The R16 enhanced EUTRA-NR inter-RAT measurement requirements in idle mode could be reused for NR inter-frequency measurements

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter [s] (number of DRX cycles) |
|
| 0.32 | 4.16 x M2 (13 x M2)Note 1 | 0.64 x M3 (2 x M3)Note 1 | 0.96 x M4 (3 x M4) Note 1 |
| 0.64 | 7.68 (12)) | 1.28 (2) | 1.92 (3) |
| 1.28 | 12.8(10)  | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: M2=1.5, M3=2 and M4=2 if SMTC periodicity of measured intra-frequency cell > 40 ms; otherwise M2=M2=M3=1. |

* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 2-2: if the answer to issue 2-1 is Yes, how to perform the enhancement for inter-frequency measurement in idle mode for HST** |
| **Company** | **Comments** |
| Huawei | Option 1 seems straight forward. |
| OPPO | Option 2 is also fine. |
| MediaTek | Support Option 2. In our understanding, in IDLE mode, the requirement for inter-frequency is same as EUTRA-NR inter-RAT (defined in clause 4.2.2.5.6 of TS 36.133). Thus, for HST enhancement, we can take EUTRA-NR inter-RAT as reference for inter-frequency.The NR inter-frequency measurement requirement is provided as follows for reference:

|  |
| --- |
| Inter-frequency measurement in IDLE mode (defined in clause 4.2.2.4 of TS 38.133) |
| Table 4.2.2.4-1: Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter [s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x 1.5 (36 x N1 x 1.5) | 1.28 x N1 x 1.5 (4 x N1 x 1.5) | 5.12 x N1 x 1.5 (16 x N1 x 1.5) |
| 0.64 |  | 5 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 |  | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 |  | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. |

 |

 The EUTRA-NR inter-RAT measurement requirement is provided as follows for reference:

|  |
| --- |
| EUTRA-NR inter-RAT measurement in IDLE mode (defined in clause 4.2.2.5.6 of TS 36.133) |
| Table 4.2.2.5.6-1: Tdetect,NR, TmeasureNR, and Tevaluate,NR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | Tdetect,NR [s] (number of DRX cycles) | Tmeasure,NR [s] (number of DRX cycles) | Tevaluate,NR[s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x 1.5 x N1(36 x 1.5 x N1) | 1.28 x 1.5 x N1(4 x 1.5 x N1) | 5.12 x 1.5 x N1(16 x 1.5 x N1) |
| 0.64 | 5 | 17.92 x N1(28 x N1) | 1.28 x N1(2 x N1) | 5.12 x N1(8 x N1) |
| 1.28 | 4 | 32 x N1(25 x N1) | 1.28 x N1(1 x N1) | 6.4 x N1(5 x N1) |
| 2.56 | 3 | 58.88 x N1(23 x N1) | 2.56 x N1(1 x N1) | 7.68 x N1(3 x N1) |
| NOTE 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. |

 |

|  |
| --- |
| EUTRA-NR inter-RAT measurement for HST enhancement in IDLE mode (defined in clause 4.2.2.5.6 of TS 36.133) |
| Table 4.2.2.5.6-2: Tdetect,NR\_HST, TmeasureNR\_HST, and Tevaluate,NR\_HST for UE configured with highSpeedInterRAT-NR-r16

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_HST [s] (number of DRX cycles) | Tmeasure,NR\_HST [s] (number of DRX cycles) | Tevaluate,NR\_HST[s] (number of DRX cycles) |
|
| 0.32 | 4.16 x M2 (13 x M2)Note 2 | 0.64 x M3 (2 x M3)Note 2 | 0.96 x M4 (3 x M4) Note 2 |
| 0.64 | 7.68 (12)) | 1.28 (2) | 1.92 (3) |
| 1.28 | 12.8(10)  | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: FR2 high speed requirements are not specified.Note 2: M2=1.5, M3=2 and M4=2 if SMTC periodicity of measured intra-frequency cell > 40 ms; otherwise M2=1. |

 |

 |
| QC | Support option 1.Comment towards option 2: to simplify UE implementation, aligning to NR to LTE inter-RAT measurement is better than LTE to NR. The only change is DRx cycle 1.28s, scaling from 10 to 7 for Tdetect. |
| Nokia | We are open to discuss pending on the outcome of Issue 2-1. |
| Ericsson | Support option1. But considering that Inter-frequency may need more time compared with intra-frequency, if it really causes difficulty, it can be relaxed. |
| Xiaomi | Support Option2. We share the view with MTK. Also, as Ericsson pointed out, we think the inter-frequency measurements requirement should be relaxed compared to intra-frequency measurements. |
| CATT | Support option 1.  |
| CMCC | Option 1.  |
| vivo | We support option 2. The inter-freq measurements should be performed less often than the intra-freq case. |

### Sub-topic 2-2: inter-frequency measurement without MG, connected state

**Issue 2-3: PSS/SSS detection time requirement for inter-frequency measurement without MG in connected state for HST**

* Proposals
	+ Option 1 (vivo, CATT, CMCC, Xiaomi, MTK): For inter-frequency measurement outside measurement gaps, the enhancement for intra-frequency measurement in R16 HST can be reused, i.e. M2 is reused

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2x 5 x Kp) x max(SMTC period, DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(5 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* Recommended WF
	+ 5 companies discussed this issue, and all the companies have the same view that M2 can be reused for PSS/SSS detection time requirement for inter-frequency measurement without MG.
	+ Moderator would like to check with companies whether following suggestion is agreeable:
		- For PSS/SSS detection for inter-frequency measurement without measurement gaps in connected state, the enhancement on PSS/SSS detection delay requirements specified for intra-frequency measurement in R16 HST can be reused, i.e. M2 is reused:

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2x 5 x Kp) x max(SMTC period, DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(5 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When [high speed] is not configured, M2 = 1.5. When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

|  |
| --- |
| **Issue 2-3: PSS/SSS detection time requirement for inter-frequency measurement without MG in connected state for HST** |
| **Company** | **Comments** |
| Huawei | Agree with the recommended WF |
| OPPO | Agree with the recommended WF |
| MediaTek | Support recommended WF |
| QC | Support recommended WF |
| Nokia | The recommended WF is Ok. |
| Ericsson | Support recommended WF |
| Apple | Similarly, inter-frequency measurement w/o gap is not for potential CA operation. Actually the intention is for potential handover. We are not sure how often the inter-frequency handover would occur in HST. If majority believe such enhancement is also necessary, suggestion from moderator is acceptable for us. |
| Xiaomi | Support recommended WF |
| CATT | Agree with the recommended WF. |
| CMCC | OK with the recommended WF |
| vivo | Agree with the recommended WF. |

**Issue 2-4: SSB index reading time requirement for inter-frequency measurement without MG in HST in connected state for HST**

* Proposals
	+ Option 1 (vivo, CATT, CMCC, Xiaomi, MTK): For inter-frequency measurement outside measurement gaps, the enhancement for intra-frequency measurement in R16 HST can be reused, i.e. M2 is reused

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Ceil(3 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* Recommended WF
	+ 5 companies discussed this issue, and all the companies have the same view that M2 can be reused for index detection delay requirement for inter-frequency measurement without MG.
	+ Moderator would like to check with companies whether following suggestion is agreeable:
		- * For index detection for inter-frequency measurement without measurement gaps in connected state, the enhancement on index detection delay requirements specified for intra-frequency measurement in R16 HST can be reused, i.e. M2 is reused:

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Ceil(3 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When [high speed] is not configured, M2 = 1.5. When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

|  |
| --- |
| **Issue 2-4: SSB index reading time requirement for inter-frequency measurement without MG in HST in connected state for HST** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Agree with the recommended WF |
| OPPO | Agree with the recommended WF |
| MediaTek | Support recommended WF  |
| QC | Support recommended WF |
| Nokia | The recommended WF is Ok. |
| Ericsson | Support suggestion in recommended WF  |
| Apple | same as above. If majority believe such enhancement is also necessary, suggestion from moderator is acceptable for us. |
| Xiaomi | Support recommended WF |
| CATT | Agree with the recommended WF. |
| CMCC | OK with the recommended WF |
| vivo | Agree with the recommended WF. |

**Issue 2-5: measurement delay requirement for inter-frequency measurement without MG in HST in connected state for HST**

* Proposals
	+ Option 1 (vivo, CMCC, CATT, Xiaomi, MTK): For inter-frequency measurement outside measurement gaps, the enhancement for intra-frequency measurement in R16 HST can be reused, i.e. M2 and Y are reused

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter  |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(M2 Note 2 x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil(Y Note 3 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 3: Y= 3 when SMTC <= 40ms, Y= 5 when SMTC > 40ms |

* Recommended WF
	+ 5 companies discussed this issue, and all the companies have the same view that M2 and Y can be reused for measurement delay requirement for inter-frequency measurement without MG.
	+ Moderator would like to check with companies whether following suggestion is agreeable:
		- * For measurement delay for inter-frequency measurement without measurement gaps in connected state, the enhancement on measurement delay requirements specified for intra-frequency measurement in R16 HST can be reused, i.e. M2 and Y are reused:

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter  |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(M2 Note 2 x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil(Y Note 3 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 3: When [high speed] is configured, Y= 3 when SMTC <= 40ms, Y= 5 when SMTC > 40ms |

|  |
| --- |
| **Issue 2-5: measurement delay requirement for inter-frequency measurement without MG in HST in connected state for HST** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Agree with the recommended WF |
| OPPO | Agree with the recommended WF |
| MediaTek | Support recommended WF  |
| QC | Support recommended WF |
| Nokia | The recommended WF is Ok. |
| Ericsson | Support suggestion in recommended WF  |
| Apple | same as above. If majority believe such enhancement is also necessary, suggestion from moderator is acceptable for us. |
| Xiaomi | Support recommended WF |
| CATT | Agree with the recommended WF. |
| CMCC | OK with the recommended WF |
| vivo | Agree with the recommended WF. |

### Sub-topic 2-3: inter-frequency measurement with MG, connected state

**Issue 2-6: PSS/SSS detection time requirement for inter-frequency measurement with MG in connected state for HST**

* Proposals
	+ Option 1 (QC, Apple):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(6\*M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 6 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5; When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1 |

* + Option 2 (HW, CMCC): M2 defined in Rel-16 HST is reused for inter-frequency PSS/SSS detection delay requirements
	+ Option 3 (CATT, vivo, Xiaomi, MTK):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* + Option 4 (Nokia):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, N Note 4 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(N Note 4\* M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | N Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.NOTE 4: When *highSpeedMeasFlag-r16* is not configured, N = 8; otherwise N = 5. |

* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 2-6: PSS/SSS detection time requirement for inter-frequency measurement with MG in connected state for HST** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Option 2 is the same as option3. We support both. |
| OPPO | Support Option 3 |
| MediaTek | Support Option 3. Following same logic as IDLE mode, we can take EUTRA-NR inter-RAT as reference for inter-frequency with MGs in CONNECTED mode.The NR inter-frequency measurement requirement with MGs is provided as follows for reference:

|  |
| --- |
| Inter-frequency measurement with MGs  |
| **Table 9.3.4-1: Time period for PSS/SSS detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*1.5) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. |

 |

The EUTRA-NR inter-RAT measurement requirement is provided as follows for reference:

|  |
| --- |
| EUTRA-NR inter-RAT measurement (defined in clause 8.1.2.4.21 of TS 36.133) |
| Table 8.1.2.4.21.1.1-1: Time period for PSS/SSS detection (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_irat |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8×1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. |

 |

|  |
| --- |
| EUTRA-NR inter-RAT measurement for HST (defined in clause 8.1.2.4.21 of TS 36.133) |
| Table 8.1.2.4.21.1.1-1A: Time period for PSS/SSS detection for UE configured with *highSpeedInterRAT-r16* (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_irat |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle < 320ms | Max(600ms, ceil( 8 × M) × max(MGRP, SMTC period, DRX cycle)) ×Nfreq |
| DRX cycle ≥ 320ms | 8× DRX cycle ×Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M = 1 when SMTC < = 40ms, and M = 1.5 when SMTC > 40ms |

 |

 |
| QC | We support option 1, and have the following concern for option 2 and 3We proposed to have inter-frequency measurement run faster than inter-RAT measurement. When the inter-frequency measurement is applied in neighboring cell search, it is preferred to find NR inter-frequency cells faster than LTE cells.

|  |  |
| --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN FDD (s) (DRX cycles) |
|  | Gap period = 40 ms, 20 ms | Gap period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.2.2 apply | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.16<DRx cycle<=0.32 |  Note 1(15\*CSSFinterRAT) |  |
| 0.32<DRx cycle <= 0.64 | Note 1(10\*CSSFinterRAT) |  |
| DRx cycle = 1.024 | Note 1(10\*CSSFinterRAT) | Note 1(10\*CSSFinterRAT) |
| DRx cycle = 1.28 | Note 1(8\*CSSFinterRAT) | Note 1(8\*CSSFinterRAT) |
| 1.28< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT) | Note1 (20\*CSSFinterRAT) |
| NOTE 1: The time depends on the DRX cycle length.NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2. |

The T\_identify is PSS/SSS detection time plus measurement, therefore, if we keep 8 DRx cycles for both PSS/SSS detection and measurement period for DRx <= 320ms, inter-frequency becomes slower than inter-RAT measurement in HST. In addition to comparison with the inter-RAT measurement, when comparing to intra-frequency measurement, one additional DRx cycle is needed to adjust AGC after retuning. Therefore, we propose to reduce DRx cycle scaling to 6. |
| Nokia  | Option 4 is supported for the following reason:* In HST deployment scenarios, SCells are typically co-located with PCells, providing the same coverage. There is no difference between PCells and SCells except for the frequency but not significant. Thus, additional samples are not needed for AGC adjustment of power amplifiers compared with SCells in non-HST scenarios.

Thus, the scaling factor 8 is reduced to 5 which is the same as the intra-frequency case.  |
| Ericsson | We suppose option2 and option 3 are almost same, enhancement is derived from value of M2. |
| Apple | is option 2 same as option 3? We propose option 1 but we are also fine with option 2 and 3. |
| Xiaomi  | Support Option 3. |
| CATT | Support option 2 & 3.  |
| CMCC | In our contribution, we only mentioned M2 can be reused, but we are open to the discussion on the number of samples. We support option 1. |
| vivo | Support option 2 & 3. For QC’s comment, we see UE can still perform faster measurement to NR cell compared to that of LTE, while the meeting the requirement proposed by option 2 & 3 at the same time. |

**Issue 2-7: SSB index reading time requirement for inter-frequency measurement with MG in HST in connected state for HST**

* Proposals
	+ Option 1 (QC, vivo, CATT, HW, CMCC, Xiaomi, Apple, MTK, Nokia): M2 is reused

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* Recommended WF
	+ 9 companies discussed this issue, and all the companies have the same view that M2 can be reused for index detection delay requirement for inter-frequency measurement without MG.
	+ Moderator would like to check with companies whether following suggestion is agreeable:
		- * For index detection for inter-frequency measurement without measurement gaps in connected state, M2 is reused:

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [high speed] is not configured, M2 = 1.5. When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

|  |
| --- |
| **Issue 2-7: SSB index reading time requirement for inter-frequency measurement with MG in HST in connected state for HST** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Support the recommended WF |
| OPPO | Support the recommended WF |
| MediaTek | Support recommended WF |
| Nokia  | The recommended WF is Ok. |
| Ericsson | Support recommended WF  |
| Apple | ok with moderator’s suggestion. |
| Xiaomi | Support recommended WF |
| CATT | Agree with the recommended WF. |
| CMCC | OK with the recommended WF |
| vivo | Agree with the recommended WF. |

**Issue 2-8: measurement delay requirement for inter-frequency measurement with MG in HST in connected state for HST**

* Proposals
	+ Option 1 (QC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(6 x M2 Note 3) x max(SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(5 x M2 Note 3 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil( Y Note 4 x Kp ) x DRX cycle x CSSFintra |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

* + Option 2 (HW):

-7 samples for 160ms < DRX cycle≤ 320ms

-6 samples for DRX cycle>320ms and SMTC <= 40ms

* + Option 3 (CATT):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 160ms | Max(200ms, Ceil(8 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms < DRX cycle≤ 320ms | Max(200ms, Ceil(7 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* + Option 4 (CMCC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms <DRX cycle ≤ 320ms | Max(200ms, Ceil([4] × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y1= [3] when SMTC <= 40ms, Y1= [8] when SMTC > 40ms |

* + Option 5 (vivo, Xiaomi): For inter-frequency measurement with MG, the enhanced requirements specified for LTE-NR inter-RAT measurements in R16 HST could be used as baseline
	+ Option 6 (Apple):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, [6] × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil([6] × M2NOTE 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | [6] × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [*highSpeedMeasFlag-r17*] is not configured, M2 = 1.5; When [*highSpeedMeasFlag-r17*] is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

* + Option 7 (MTK):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

* + Option 8 (Nokia):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 5 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(5 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160 ms ≤DRX cycle ≤ 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| DRX cycle > 320ms |  Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 2-8: measurement delay requirement for inter-frequency measurement with MG in HST in connected state for HST** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Support Option2Regarding legacy inter-frequency measurement period, 8 samples are applied where 3 additional samples are for AGC setting. As for intra-frequency measurement period in HST, sample numbers are reduced from 5 to 4 for 160ms < DRX cycle≤ 320ms, and reduced to 3 for DRX cycle>320ms and SMTC <= 40ms. It is suggested that 3 samples are still remained for AGC settling. Thus for inter-frequency measurement period with high speed-7samples for 160ms < DRX cycle≤ 320ms-6 samples for DRX cycle>320ms and SMTC <= 40ms |
| OPPO | Agree with option 2 and 5. The methods of sample reduction for HST intra-frequency or inter-RAT measurement can be reused. |
| MediaTek | Support option 7.Following same logic as IDLE mode, we can take EUTRA-NR inter-RAT as reference for inter-frequency with MGs in CONNECTED mode.The NR inter-frequency measurement requirement with MGs is provided as follows for reference:

|  |
| --- |
| Inter-frequency measurement with MGs  |
| **Table 9.3.5-1: Measurement period for inter-frequency measurements with gaps (Frequency FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. |

 |

The EUTRA-NR inter-RAT measurement requirement is provided as follows for reference:

|  |
| --- |
| EUTRA-NR inter-RAT measurement (defined in clause 8.1.2.4.21 of TS 36.133) |
| Table 8.1.2.4.21.1.1-5: Measurement period for inter-RAT measurements (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_measurement\_period\_irat |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. |

 |

|  |
| --- |
| EUTRA-NR inter-RAT measurement for HST (defined in clause 8.1.2.4.21 of TS 36.133) |
| Table 8.1.2.4.21.1.1-5A: Measurement period for inter-RAT measurements for UE configured with *highSpeedInterRAT-r16* (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_measurement\_period\_irat |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle < 320ms | Max(200ms, ceil(8 × M) x max(MGRP, SMTC period, DRX cycle))×Nfreq |
| DRX cycle ≥ 320ms | 4× M × DRX cycle ×Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M = 1 when SMTC < = 40ms, and M = 1.5 when SMTC > 40ms |

 |

 |
| QC | Same comment we posted for PSS/SSS applies to this issue. We believe 1 sample is enough for AGC. For longer DRx cycle (>320ms) cases, we can revise our proposal to 4 and 6 depending on SMTC. |
| Nokia | Option 8 is supported for the same reason as in Issue 2-6:* In HST deployment scenarios, SCells are typically co-located with PCells, providing the same coverage. There is no difference between PCells and SCells except for the frequency but not significant. Thus, additional samples are not needed for AGC adjustment of power amplifiers compared with SCells in non-HST scenarios.

Thus, the scaling factor 8 is reduced to 5 which is the same as the intra-frequency case.  |
| Ericsson | Slightly support option 6 and option 7 to avoid tightening requirement too much. |
| Apple | We are open to further discussion.  |
| Xiaomi | Prefer Option 5 and Option 7. |
| CMCC | Option 4, but we are open to the value of Y. In Rel-16 HST WI, both intra-frequency measurement requirements and inter-RAT measurement requirements are specified. Compared with the measurement within NR, there is some relaxation on inter-RAT measurement performance. From mobility point of view, it is preferred to take intra-frequency measurement requirements as baseline to define the inter-frequency measurement enhancement, but for the exact value of Y, we are open to discussion. |
| vivo | Can be FFS. |

### Sub-topic 2-4: the principle on the requirements if there are HST inter-frequency layers and non-HST inter-frequency layers to be measured

**Issue 2-9: the principle on the requirements if there are HST inter-frequency layers and non-HST inter-frequency layers to be measured**

* Proposals
	+ Option 1 (HW): If RAN4 decided to specify inter-frequency measurement enhancement in FR1 HST, the requirements shall follow the principle:

NHST\_inter-f carrier \* THST\_interf + NnonHST\_inter-f carrier \* TnonHST\_interf

* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 2-9: the principle on the requirements if there are HST inter-frequency layers and non-HST inter-frequency layers to be measured** |
| **Company** | **Comments** |
| XXX |  |
| Huawei | Support option 1. The above principle is applied in R16 HST inter-RAT cell reselection in idle mode. |
| OPPO | We should first investigate whether it is a valid or common case that UE performs HST and non-HST measurement at the same time. |
| MediaTek | This issue is depending on Issue 2-1 so we suggest to wait for that conclusion. |
| QC | Option 1 is reasonable to us. |
| Nokia | Further details are needed to understand the rationale behind the proposal (which is based in inter-RAT).  |
| Ericsson | Support option1 if it is already in R16. But questions from OPPO and Nokia are valuable to be followed.  |
| Apple | We support the principle. We have similar principle in our mind as captured in Issue 3-5. |
| CATT | Option 1 seems reasonable like current inter-RAT. |
| vivo | We are fine with the principle of option 1, and agree with Huawei that it needs to be clarified for idle mode only. Therefore, it is better under issue 2-1. Moreover, as discussed in R16, we think the higher priority layer may also need to be discussed. Following this principle, we would like to check with companies whether no enhancements is applied to higher-priority inter-frequency layer in idle mode. |

## 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** |
| 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 #2-1 inter-frequency measurement in idle state** | **Issue 2-1: whether define the enhancement for inter-frequency measurement in idle mode for HST***Candidate options:*Option 1 (HW, OPPO, QC, Ericsson, Xiaomi, CATT, CMCC, vivo): YesOption 2 (MTK, Nokia): NoOption 3 (Apple): introduce a dedicated UE capability indicating the support of inter-frequency measurement in idle mode for HST*Recommendations for 2nd round:*Continue the discussion**Issue 2-1: if the answer to issue 2-1 is Yes, how to perform the enhancement for inter-frequency measurement in idle mode for HST***Candidate options:*Option 1 (HW, QC, CATT, CMCC, Ericsson): using the same requirement as for intra-frequency measurement for HST

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter[s] (number of DRX cycles) |
|  |
| 0.32 | 2.56 x M2 (8 x M2) | 0.32 x M3 (1 x M3) | 0.96 x M4 (3 x M4) |  |
| 0.64 | 5.12 (8) | 0.64 (1) | 1.92 (3) |  |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |  |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |  |
| Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 |  |

Option 2 (OPPO, Xiaomi, MTK, vivo): The R16 enhanced EUTRA-NR inter-RAT measurement requirements in idle mode could be reused for NR inter-frequency measurements

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter [s] (number of DRX cycles) |
|
| 0.32 | 4.16 x M2 (13 x M2)Note 1 | 0.64 x M3 (2 x M3)Note 1 | 0.96 x M4 (3 x M4) Note 1 |
| 0.64 | 7.68 (12)) | 1.28 (2) | 1.92 (3) |
| 1.28 | 12.8(10)  | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: M2=1.5, M3=2 and M4=2 if SMTC periodicity of measured intra-frequency cell > 40 ms; otherwise M2=M2=M3=1. |

*Recommendations for 2nd round:*Continue the discussion |
| **Sub-topic #2-2 inter-frequency measurement without MG, connected state** | **Issue 2-3: PSS/SSS detection time requirement for inter-frequency measurement without MG in connected state for HST***Tentative agreements:*For PSS/SSS detection for inter-frequency measurement without measurement gaps in connected state, the enhancement on PSS/SSS detection delay requirements specified for intra-frequency measurement in R16 HST can be reused, i.e. M2 is reused:

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2x 5 x Kp) x max(SMTC period, DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(5 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When [high speed] is not configured, M2 = 1.5. When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

**Issue 2-4: SSB index reading time requirement for inter-frequency measurement without MG in HST in connected state for HST***Tentative agreements:*For index detection for inter-frequency measurement without measurement gaps in connected state, the enhancement on index detection delay requirements specified for intra-frequency measurement in R16 HST can be reused, i.e. M2 is reused:

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Ceil(3 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When [high speed] is not configured, M2 = 1.5. When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

**Issue 2-5: measurement delay requirement for inter-frequency measurement without MG in HST in connected state for HST***Tentative agreements:*For measurement delay for inter-frequency measurement without measurement gaps in connected state, the enhancement on measurement delay requirements specified for intra-frequency measurement in R16 HST can be reused, i.e. M2 and Y are reused:

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter  |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(M2 Note 2 x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil(Y Note 3 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identifiedNOTE 2: When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 3: When [high speed] is configured, Y= 3 when SMTC <= 40ms, Y= 5 when SMTC > 40ms |

 |
| **Sub-topic #2-3 inter-frequency measurement with MG, connected state** | **Issue 2-6: PSS/SSS detection time requirement for inter-frequency measurement with MG in connected state for HST***Candidate options:** + Option 1 (QC, Apple, CMCC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(6\*M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 6 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5; When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1 |

* + Option 3 (CATT, vivo, Xiaomi, MTK, HW, Ericsson, Apple):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* + Option 4 (Nokia):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, N Note 4 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(N Note 4\* M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | N Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.NOTE 4: When *highSpeedMeasFlag-r16* is not configured, N = 8; otherwise N = 5. |

*Recommendations for 2nd round:*Continue the discussion**Issue 2-7: SSB index reading time requirement for inter-frequency measurement with MG in HST in connected state for HST***Tentative agreements:*For index detection for inter-frequency measurement with measurement gaps in connected state, M2 is reused:

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [high speed] is not configured, M2 = 1.5. When [high speed] is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

**Issue 2-8: measurement delay requirement for inter-frequency measurement with MG in HST in connected state for HST***Candidate options:** + Option 1 (QC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(6 x M2 Note 3) x max(SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(5 x M2 Note 3 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil( Y Note 4 x Kp ) x DRX cycle x CSSFintra |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

* + Option 2 (HW, OPPO):

-7 samples for 160ms < DRX cycle≤ 320ms-6 samples for DRX cycle>320ms and SMTC <= 40ms* + Option 3 (CATT):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 160ms | Max(200ms, Ceil(8 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms < DRX cycle≤ 320ms | Max(200ms, Ceil(7 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* + Option 4 (CMCC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms <DRX cycle ≤ 320ms | Max(200ms, Ceil([4] × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y1= [3] when SMTC <= 40ms, Y1= [8] when SMTC > 40ms |

* + Option 5 (vivo, Xiaomi, OPPO): For inter-frequency measurement with MG, the enhanced requirements specified for LTE-NR inter-RAT measurements in R16 HST could be used as baseline
	+ Option 6 (Apple, Ericsson):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, [6] × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil([6] × M2NOTE 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | [6] × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [*highSpeedMeasFlag-r17*] is not configured, M2 = 1.5; When [*highSpeedMeasFlag-r17*] is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

* + Option 7 (MTK, Ericsson, Xiaomi):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

* + Option 8 (Nokia):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 5 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(5 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160 ms ≤DRX cycle ≤ 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| DRX cycle > 320ms |  Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

*Recommendations for 2nd round:*Continue the discussion |
| **Sub-topic #2-4 the principle on the requirements if there are HST inter-frequency layers and non-HST inter-frequency layers to be measured** | **Issue 2-9: the principle on the requirements if there are HST inter-frequency layers and non-HST inter-frequency layers to be measured***Candidate options:** Option 1 (HW, QC, Ericsson, Apple, CATT, vivo): If RAN4 decided to specify inter-frequency measurement enhancement in FR1 HST, the requirements shall follow the principle:

NHST\_inter-f carrier \* THST\_interf + NnonHST\_inter-f carrier \* TnonHST\_interf* Option 2 (OPPO, MTK, Nokia): FFS

*Recommendations for 2nd round:*Continue the discussion |

### 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)

### Sub-topic 2-1: inter-frequency measurement in idle state

**Issue 2-1: whether define the enhancement for inter-frequency measurement in idle mode for HST**

*Candidate options:*

* Option 1 (HW, OPPO, QC, Ericsson, Xiaomi, CATT, CMCC, vivo): Yes
* Option 2 (MTK, Nokia, Apple): No
* Option 3 (Apple): introduce a dedicated UE capability indicating the support of inter-frequency measurement in idle mode for HST

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 2-1: whether define the enhancement for inter-frequency measurement in idle mode for HST** |
| **Company** | **Comments** |
| vivo | Option 1. Same comments as the 1st round.  |
| Apple | We support option 2 as mentioned in the last meeting and in the 1st round discussion. Reasons are: 1) inter-frequency cell reselection is not that often as intra-frequency. 2) UE power consumption would be increased. 3) without enhancement on inter-frequency the feature can still work, i.e. inter-frequency cell reselection would still be allowed and UE can still receive paging. |
| MediaTek | Support option 2. For option 3, we are not sure how network can leverage capability in IDLE mode?  |

**Issue 2-2: if the answer to issue 2-1 is Yes, how to perform the enhancement for inter-frequency measurement in idle mode for HST**

*Candidate options:*

* Option 1 (HW, QC, CATT, CMCC, Ericsson): using the same requirement as for intra-frequency measurement for HST

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter[s] (number of DRX cycles) |
|  |
| 0.32 | 2.56 x M2 (8 x M2) | 0.32 x M3 (1 x M3) | 0.96 x M4 (3 x M4) |  |
| 0.64 | 5.12 (8) | 0.64 (1) | 1.92 (3) |  |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |  |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |  |
| Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 |  |

* Option 2 (OPPO, Xiaomi, MTK, vivo): The R16 enhanced EUTRA-NR inter-RAT measurement requirements in idle mode could be reused for NR inter-frequency measurements

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter [s] (number of DRX cycles) |
|
| 0.32 | 4.16 x M2 (13 x M2)Note 1 | 0.64 x M3 (2 x M3)Note 1 | 0.96 x M4 (3 x M4) Note 1 |
| 0.64 | 7.68 (12)) | 1.28 (2) | 1.92 (3) |
| 1.28 | 12.8(10)  | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: M2=1.5, M3=2 and M4=2 if SMTC periodicity of measured intra-frequency cell > 40 ms; otherwise M2=M2=M3=1. |

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 2-2: if the answer to issue 2-1 is Yes, how to perform the enhancement for inter-frequency measurement in idle mode for HST** |
| **Company** | **Comments** |
| vivo | Option 2 is preferred. Relaxation to inter-frequency measurements compared to that for intra-frequency should be introduced. As mentioned by some other companies, UE should be able to save power in IDLE mode. |
| Apple | Depends on 2-1. |
| MediaTek | Support option 2. Considering that the inter-frequency measurements requirement should be relaxed compared to intra-frequency measurements. Besides, inter-frequency measurement is similar to inter-RAT. Thus, we suggest to follow the similar rule as inter-RAT. |

### Sub-topic 2-2: inter-frequency measurement with MG, connected state

**Issue 2-3: PSS/SSS detection time requirement for inter-frequency measurement with MG in connected state for HST**

*Candidate options:*

* Option 1 (QC, Apple, CMCC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(6\*M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 6 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5; When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1 |

* Option 2 (CATT, vivo, Xiaomi, MTK, HW, Ericsson, Apple):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* Option 3 (Nokia):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, N Note 4 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(N Note 4\* M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | N Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.NOTE 4: When *highSpeedMeasFlag-r16* is not configured, N = 8; otherwise N = 5. |

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 2-3: PSS/SSS detection time requirement for inter-frequency measurement with MG in connected state for HST** |
| **Company** | **Comments** |
| vivo | Prefer option 2.For option 1, from deployment perspective we see it would be strange when a carrier is regarded as inter-frequency carrier in NR, then it should be measured more often than that when this same carrier is regarded as an inter-RAT carrier in LTE. However if operator can provide more justifications to the scenario, then we are open to discuss option 1. |
| Apple | Fine with either option 1 and 2. |
| MediaTek | Support option 2. Intention is to follow inter-RAT logic for inter-frequency measurement. |

**Issue 2-4: measurement delay requirement for inter-frequency measurement with MG in HST in connected state for HST**

*Candidate options:*

* Option 1 (QC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(6 x M2 Note 3) x max(SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(5 x M2 Note 3 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil( Y Note 4 x Kp ) x DRX cycle x CSSFintra |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

* Option 2 (HW, OPPO):

-7 samples for 160ms < DRX cycle≤ 320ms

-6 samples for DRX cycle>320ms and SMTC <= 40ms

* Option 3 (CATT):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 160ms | Max(200ms, Ceil(8 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms < DRX cycle≤ 320ms | Max(200ms, Ceil(7 × M2) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When high speed is not configured, M2 = 1.5. When high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. |

* Option 4 (CMCC):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160ms <DRX cycle ≤ 320ms | Max(200ms, Ceil([4] × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y1= [3] when SMTC <= 40ms, Y1= [8] when SMTC > 40ms |

* Option 5 (vivo, Xiaomi, OPPO): For inter-frequency measurement with MG, the enhanced requirements specified for LTE-NR inter-RAT measurements in R16 HST could be used as baseline
* Option 6 (Apple, Ericsson):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, [6] × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil([6] × M2NOTE 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | [6] × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When [*highSpeedMeasFlag-r17*] is not configured, M2 = 1.5; When [*highSpeedMeasFlag-r17*] is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

* Option 7 (MTK, Ericsson, Xiaomi):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1. |

* Option 8 (Nokia):

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 5 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | Max(200ms, Ceil(5 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 160 ms ≤DRX cycle ≤ 320ms | 4 × M2 Note 3× DRX cycle × CSSFinter |
| DRX cycle > 320ms |  Y Note 4 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 2-4: measurement delay requirement for inter-frequency measurement with MG in HST in connected state for HST** |
| **Company** | **Comments** |
| vivo | Actually option 5 and 7 should be the same and we can support both.Same comment as issue 2-3. |
| Apple | Prefer option 6. Open to further discussion. |
| MediaTek | Support option 7. Intention is to follow inter-RAT logic for inter-frequency measurement. |

**Issue 2-5: the principle on the requirements if there are HST inter-frequency layers and non-HST inter-frequency layers to be measured**

*Candidate options:*

* Option 1 (HW, QC, Ericsson, Apple, CATT, vivo): If RAN4 decided to specify inter-frequency measurement enhancement in FR1 HST, the requirements shall follow the principle:

NHST\_inter-f carrier \* THST\_interf + NnonHST\_inter-f carrier \* TnonHST\_interf

* Option 2 (OPPO, MTK, Nokia): FFS

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 2-5: the principle on the requirements if there are HST inter-frequency layers and non-HST inter-frequency layers to be measured** |
| **Company** | **Comments** |
| vivo | Not sure why this issue is under sub-topic 2-2.If it is for connected mode then we withdraw the support of option 1, and would prefer option 2.If it is for idle mode then we support option 1. |
| Apple | Support option 1. Distinguishing high speed inter-f and non-high speed inter-f can save UE power and facilitate measurement on high speed inter-f. |
| MediaTek | Support option 2. This is principle is used for IDLE mode inter-frequency measurement. Thus, we suggest to wait for the conclusion in Issue 2-1. |

# Topic #3: other

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109061**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109061.zip) | CATT | **Proposal 1: For SCell link recovery, it depends on network. There is no need to have the limitation in the spec.****Proposal 2: For CSSF, it depends on network. There is no need to have the limitation in the spec.****Proposal 3: Rel-17 NR HST RRM enhancement can be release independent from Rel-15.** |
| [**R4-2109514**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109514.zip) | CMCC | L1-SINR *Observation 1: the configuration of CMR/IMR is up to network configuration, there is no restriction on L1-SINR for HST scenario.**Observation 2: for SS-SINR, the reason to have upper bound of side condition is that there will be large frequency offset on the measurement of neighbour cell, which may result in ISI and have impact on the measurement of neighbour cell.**Observation 3: for L1-SINR, the measurement is performed on serving cell, there is no high frequency offset issue.****Proposal 1: legacy L1-SINR accuracy requirements can be reused for high speed train scenario, no restriction is needed.***Scell link recovery***Proposal 2: for scell link recovery, it is not preferred to have restriction on the number of band(s) supported for FR1 HST in the spec.***CSSF***Proposal 3: for CSSF, it is not preferred to have restriction on the number of Scell (s) supported for FR1 HST in the spec.***Network assistant signaling*Observation 4: according to TS38.331, legacy network assistant signaling highSpeedMeasFlag-r16 is transmitted in RRC IEs ServingCellConfigCommon, which means that highSpeedMeasFlag-r16 is signaled for SCell.**Observation 5: According to this IE description in TS38.331, highSpeedMeasFlag-r16 is used to indicate UE to apply enhanced RRM requirements to support high speed up to 500 km/h as specified in TS 38.133, which can be seen that this IE is more like a general indication of high speed train condition for RRM enhancement.****Proposal 4: it is proposed for RAN4 to further check whether highSpeedMeasFlag-r16 can be reused for the indication of application of enhanced RRM requirements for HST CA.***Release independent***Proposal 5: it is proposed that Rel-17 FR1 HST RRM enhancement is release independent from Rel-15.*** |
| [**R4-2109562**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109562.zip) | Qualcomm, Inc. | **Proposal 1: RAN4 to define the enhancement for inter-frequency measurement in idle mode.****Proposal 2: Set HST idle mode inter-frequency measurement requirement as Table 2-2.**

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter [s] (number of DRX cycles) | Tmeasure,NR\_Inter [s] (number of DRX cycles) | Tevaluate,NR\_Inter[s] (number of DRX cycles) |
|  |
| 0.32 | 2.56 x M2 (8 x M2) | 0.32 x M3 (1 x M3) | 0.96 x M4 (3 x M4) |  |
| 0.64 | 5.12 (8) | 0.64 (1) | 1.92 (3) |  |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |  |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |  |
| Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 |  |

Table 2‑2 Idle mode inter-frequency measurement requirement for HST**Proposal 3: Set HST connected mode inter-frequency measurement requirement as Table 2-3~5.**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(6\*M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 6 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 |

Table 2‑3 PSS/SSS detection time for inter-frequency measurement requirement in HST

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 6 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(6 x M2 Note 3) x max(SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(5 x M2 Note 3 x Kp) x max(SMTC period,DRX cycle) |
| DRX cycle>320ms | ceil( Y Note 4 x Kp ) x DRX cycle x CSSFintra |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1NOTE 4: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms |

Table 2‑4 SSB measurement time for inter-frequency measurement requirement in HST

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 |

Table 2‑5 SSB index reading time for inter-frequency measurement requirement in HST**Proposal 4: Follow Kp setting in R15 deactivated scell measurement requirement for HST enhancement.** |
| [**R4-2109633**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109633.zip) | MediaTek inc. | **Proposal 1: RAN4 need to confirm whether L1-SINR measurement is applied for HST or not. If not, then RAN4 may define no L1-SINR measurement requirement for HST clearly in TS 38.133.****Proposal 2: If RAN4 confirm the L1-SINR measurement will be applied for HST, then the upper bound of the side condition SSB Ês/Iot ≤5 dB should be introduced, for CMR only case at least.****Proposal 3: For SCell link recovery, RAN4 needs to study how many band(s) is supported in R17 HST in FR1.****Proposal 4: For CSSF, RAN4 needs to study how many SCell(s) is supported in R17 HST in FR1.** |
| [**R4-2110060**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110060.zip) | OPPO | ***Observation 1: Enhancements for RRC IDLE inter-frequency measurements rely on operators’ deployment demand.******Proposal 1: It is optional UE capability to be introduced for supporting HST inter-frequency measurement enhancement, including RRC Connected and Idle state.******Proposal 2: Clarify firstly whether L1-SINR measurement requirement is not applicable to HST or not.*** ***Observation 2: The number of bands should rely on both network configuration and UE capability of performing link recovery on CCs simultaneously.******Proposal 3: The link recovery requirements for R17 FR1 HST can follow the assumption of non-HST case, where the same limitation of non-HST scenarios should apply.******Proposal 4: CSSF should follow the assumption of non-HST case, without limitation on the number of Scells.******Proposal 5: Introduce new UE capability for supporting velocity up to 500km/h.******Observation 3: FFS release independent issues before conclusion of other issues related to new UE capabilities.*** |
| [**R4-2110212**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110212.zip) | Ericsson | ***Observation1: Enhancement on NSCC\_SSB for HST has two interpretations:**** ***Option1: Not both SCell(s) measured without MG and SCell(s) measured with MG are counted in NSCC\_SSB, which impacts the assumption of searcher limitation agreed before. it should be avoided to keep consistency between Non-HST and HST and revision consistency.***
* ***Option2: Limit NSCC\_SSB number. It is equal to limit CSSF value in second issue in fact and doesn’t change searcher limitation.***

***Proposal 1: Support option2, it isn’t suggested to explicitly limit CSSF value, i.e. number of Scell(s) supported in R17 HST FR1. It relies on network configuration.******Proposal 2: Issue of Kp for deactivated Scell*** ***also exists in non-HST scenario and R15, we prefer to stop discussion until clear conclusion and agreement in R15.*** ***Proposal 3: Support option 1. Rel-17 FR1 HST RRM enhancement can be release independent from Rel-15, similar with Rel-16 NR HST RRM enhancement.*** |
| [**R4-2110377**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110377.zip) | Huawei, HiSilicon | **Proposal 1: Kp shall also apply for measurement requirements on deactivated SCell in R17 FR1 HST, where Kp = 1/(1- (SMTC period /MGRP)).****Proposal 2: The HST enhanced inter-frequency measurement requirements can be defined as,*** **M2 defined in Rel-16 HST is reused for inter-frequency PSS/SSS detection delay requirements,**
* **M2 defined in Rel-16 HST is reused for inter-frequency time index detection delay requirements,**
* **Inter-frequency measurement period with high speed**

**-7 samples for 160ms < DRX cycle≤ 320ms****-6 samples for DRX cycle>320ms and SMTC <= 40ms****Proposal 3: If RAN4 decided to specify inter-frequency measurement enhancement in FR1 HST, the requirements shall follow the principle:****NHST\_inter-f carrier  \* THST\_interf + NnonHST\_inter-f carrier  \* TnonHST\_interf****Proposal 4: The same limitation on the number of band(s) on which UE is performing beam failure detection for SCell in R16 can be reused in R17 HST.** |
| [**R4-2111252**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111252.zip) | Nokia, Nokia Shanghai Bell | Proposal 1: NSCC\_SSB enhancements should cover non-HST as well as HST. **Proposal 2: L1-SINR for CMR only does not seem to face the same side condition problem as SS-SINR; RAN4 can further validate.** **Proposal 3: Regarding CSSF, no need to have this limitation in the spec is preferred.**  |
| [**R4-2111261**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111261.zip) | vivo | **Proposal 1 No need to specify upper bound of the side condition as 5dB for L1-SINR.****Proposal 2 No need to have any limitation on the number of bands in the spec.****Proposal 3 No need to have any limitation on the number of bands in the spec.****Proposal 4 The release independent issue is not discussed until the features discussed in R17 FR1 HST becomes stable.** |
| [**R4-2111262**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111262.zip) | vivo | **Proposal 1 Further discuss the issue of CSSFoutside\_gap issue under TEI16.****Proposal 2 Rel-15/Rel-16 Kp requirements modification (if any) shall also apply for R17 HST.** |
| [**R4-2111263**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111263.zip) | vivo | **Proposal 1 For the scenarios of inter-frequency measurements, NR-DC scenarios can be considered.****Proposal 2 Inter-RAT NR carrier measurement requirements specified in TS 36.133 for R16 HST WI can be used at least as a baseline for inter-frequency measurement requirements within measurement gaps discussed in R17 FR1 HST WI.****Proposal 3 For inter-frequency measurement outside measurement gaps, similar enhancements that have been done to intra-frequency requirements in R16 HST can be re-used for R17 HST.****Proposal 4 CSSF enhancements for inter-frequency measurements can be considered for R17 HST.****Proposal 5 Idle/inactive inter-frequency requirements are also enhanced in R17 HST.** |

## 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 3-1: L1-SINR

**Issue 3-1: L1-SINR**

* Proposals
	+ Option 1 (CMCC): legacy L1-SINR accuracy requirements can be reused for high speed train scenario, no restriction is needed
	+ Option 1a (vivo): No need to specify upper bound of the side condition as 5dB for L1-SINR
	+ Option 2 (MTK, Ericsson): If RAN4 confirm the L1-SINR measurement will be applied for HST, then the upper bound of the side condition SSB Ês/Iot ≤5 dB should be introduced, for CMR only case at least
	+ Option 3 (MTK, OPPO ): Clarify firstly whether L1-SINR measurement requirement is not applicable to HST or not
* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 3-1: L1-SINR** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Option3 is suggested to be discussed firstly: whether L1-SINR reporting is needed in HST. The intention of L1-SINR reporting is for beam management. In typical FR1 HST network, the transmit beam is only 2. The necessity of configuration of L1-SINR report is not clear.If operators confirm to use L1-SINR in high speed scenario, we think there may be a cap on SINR upper bound. Although L1-SINR focus on serving cell which is different with SS-SINR, the Doppler shift is still larger than the non-HST scenario. We suggest to further evaluate this issue. |
| OPPO | We proposed option 3 that whether L1-SINR reporting is needed in HST should be clarified. From our side, L1-SINR measurement seems not so necessary for FR1 HST. But we are open to further discuss this. |
| MediaTek | Support Option 2 and 3.In our understanding, the L1-SINR for CMR only case at least may have the similar situation as SS-SINR in R16 HST. Because the UE may move between two opposite beam directions from two RRHs. And these two RRH belong to one cell. Thus, for the serving cell, UE may have large impact on L1-SINR because of Doppler shift.  |
| QC | CMR requires measurement of neighobring cell, hence the upper bound is needed if L1-SINR measurement requirement applies to HST |
| Nokia | The proposal in our contribution (seems to be missing) is: **Proposal 2: L1-SINR for CMR only does not seem to face the same side condition problem as SS-SINR; RAN4 can further validate.** The rationale behind our proposal is as follows:* A similar problem to SS-SINR could arise when the UE is in the middle between 2 RRHs within the same serving cell, where the Doppler frequency received by the UE from 2 adjacent RRHs has opposite sign.
* As the RRHs belong to the same cell, it is feasible for the UE to track and compensate for Doppler frequency of the opposite sign.
 |
| Ericsson | Support option2. But If UE can mitigate Doppler shift effect within one cell, we can compromise on it.  |
| CATT | Support option 3.  |
| CMCC | Option 1. We do not see the restriction that L1-SINR cannot be used for HST. As for the upper bound of side condition, for the measurement on neighbor cell, the doppler shift will be doubled, that is why we have cap for SS-SINR. But for L1-SINR, since it is measured on the serving cell, the doppler shift will not be doubled, in our view, no cap in needed. But if companies think that the measurement performance will be impacted due to the higher doppler shift compared with that for non-HST, we are fine to have further discussion and it is necessary to have evaluation to evaluate the impact. |
| vivo | Support option 1 and option 1a. CMR-only case is only defined for CSI-RS based measurements, and we do not see the issue of ICI caused by Doppler spread, if the TCI state for CSI-RS measurement is properly configured. Since the L3 SS-SINR has limited performance, and L3 CSI-SINR only consider timing difference within CP/2, we think it is possible to use L1-SINR. |

### Sub-topic 3-2: SCell link recovery

**Issue 3-2: SCell link recovery**

* Proposals
	+ Option 1 (CATT, CMCC, vivo): For SCell link recovery, it depends on network. There is no need to have the limitation on the number of band(s)in the spec
	+ Option 2 (MTK): For SCell link recovery, RAN4 needs to study how many band(s) is supported in R17 HST in FR1
	+ Option 3 (OPPO, HW): The same limitation on the number of band(s) on which UE is performing beam failure detection for SCell in R16 can be reused in R17 HST
* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 3-2: SCell link recovery** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Support Option 3. In R16 eMIMO WI, BFD and CBD are extended to be performed on SCell. There is a restriction that UE is required to perform beam failure detection on no more than 1 serving cell per band. The scaling factor “PBFD” and “PCBD” are introduced for BFD and CBD requirements respectively. In ENDC or NEDC or SA, the “PBFD” and “PCBD” is Z for SCell where Z is the number of band(s) on which UE is performing beam failure detection only for SCell. In R17 HST, the same limitation on SCells can be reused for SCell link recovery. |
| OPPO | Option 3 |
| MediaTek | Support option 2. In our understanding, more band means more delay which is not feasible for HST deployment. If we go with option 1, it means UE is allowed to perform beam failure recovery with loner delay and NW should guarantee the UE would not experience beam failure along the railway. |
| QC | Support option 3. |
| Nokia | Options 1 and 3 are Ok. |
| Ericsson | We have not strong view, option1 and option3 are not controversial. If R16 can conclude limitation on band number in SCell link recovery, then R17 HST can follow it. HST has not specific reason to SCell link recovery. But Z still is decided by network. Another question about ‘PBFD’and’PCBD’ is only TEvaluate\_BFD\_CSI-RSincludes the two parameters, how about SSB based BFD? |
| CATT | Option 1.  |
| CMCC | Prefer option 1, but we are open to have further discussion on option 3. |
| vivo | Fine with option 3. |

### Sub-topic 3-3: CSSF

**Issue 3-3: CSSF**

* Proposals
	+ Option 1(CATT, CMCC, Ericsson, Nokia, vivo): For CSSF, it depends on network. There is no need to have the limitation on the number of Scell (s) in the spec
	+ Option 2 (MTK): For CSSF, RAN4 needs to study how many SCell(s) is supported in R17 HST in FR1
	+ Option 3 (OPPO): CSSF should follow the assumption of non-HST case, without limitation on the number of Scells
* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 3-3: CSSF** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Option 1. Suggest to leave flexibility to network. |
| OPPO | Option 1and 3 are fine, which are not contradictory. |
| MediaTek | Support option 2. In our understanding, larger CSSF means longer measurement period which is not feasible for HST deployment. It will be strange if we try to minimize the number of samples in Scell measurement period but we allow a large CSSF value to scale up the total measurement delay.  |
| QC | Support option 1. |
| Nokia | Options 1 and 3 are OK because network is not expected to configure a large number of Scells. |
| Ericsson | Support option1 and option3, they aren’t controversial. |
| CATT | Option 1.  |
| CMCC | Option 1 |
| vivo | Option 1. |

3

### Sub-topic 3-4: signalling

**Issue 3-4: UE capability**

* Proposals
	+ Option 1 (OPPO, MTK): It is optional UE capability to be introduced for supporting HST inter-frequency measurement enhancement, including RRC Connected and Idle state
	+ Option 2 (CMCC): it is necessary to discuss whether a single UE capability can cover both CA enhancement and inter-frequency measurement enhancement
* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 3-4: UE capability** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | There is a parallel discussion in R16 HST capability where separate capability of intra-NR and inter-RAT NR are introduced additionally. To avoid such situation, decouple each capability is more attractive. So CA, inter-frequency measurement are suggested to be separate capability. |
| OPPO | Agree to introduce optional UE capability for HST inter-frequency measurement enhancement |
| MediaTek | Support option 1. We are open to discuss but we suggest to finalize the requirement first. |
| Ericsson | Slightly support option 1, but we prefer to keep it open before inter-frequency measurements have agreements. |
| QC | We prefer option 1, but keeping it open until requirement finalized is good for us, too. |
| CMCC | We are OK to keep it open now. |
| vivo | Prefer option 1. |

**Issue 3-5: Network assistant ignalling**

* Proposals
	+ Option 1 (CMCC): it is proposed for RAN4 to further check whether highSpeedMeasFlag-r16 can be reused for the indication of application of enhanced RRM requirements for HST CA
	+ Option 2 (Apple): NW shall indicate which inter-frequency layers need to be measured more often, for which enhanced inter-frequency measurement requirements shall apply
* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 3-5: Network assistant signaling** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Agree with option 1. As High speed network is dedicated network, the indication from network can be very simple. For example, when network has knowledge users are present in the network, an single indication for R17 RRM measurement enhancement can be indicated. Whether UE can support CA or inter-frequency measurement depends on UE reported capability.  |
| OPPO | Option 1 is fine. We can further discuss this after conclusion on other UE capability signaling. |
| MediaTek | Support Option 1, to follow the R16 approach as much as possible. |
| Nokia | Option 1 is our first choice for simplicity and the target UE speed for HST Scells is the same as Pcells. However, we are open to discuss if there are issues with reusing the flag.  |
| Ericsson | Agree with option1. It may be relevant with enhancement of inter-frequency measurement.For option 2, number of inter-frequency layers is limited usually. If enhanced measurement requirements can apply to one inter-frequency layer, why cannot apply to any other inter-frequency layer? |
| QC | Even if option 1 (reusing the flag) is agreed, issue 2-9 option 1 requires adding flag for inter-frequency measurement target cc to identify whether the cc is HST. |
| Apple | **Option 1 and 2 here are for different issues. They don’t conflict with each other.**Regarding proposal in option 1, usually once there is new feature, we define new flag to control it. Otherwise the interpretation of the same flag in different releases would be different. On the other hand, we don’t see any issue of using new flag to control R17 requirements.Regarding our proposal in option 2, it is in line with issue 2-9 option 1, which seems acceptable to the group. To Ericsson’s question, enhancement comes at the price of power consumption. Technically it can apply to any other inter-frequency, but it may not be necessary. We see no problem since it is up to network configuration. |
| CATT | **Option 1.**  |
| CMCC | The reason we propose option 1 is that we observe that, inTS38.331, highSpeedMeasFlag-r16 is transmitted in RRC IEs ServingCellConfigCommon, which means that highSpeedMeasFlag-r16 is signaled for SCell to indicate high speed train condition for RRM enhancement. At least from our point of view, we do not see issue to reuse highSpeedMeasFlag-r16 for CA. We are open to hear companies’ views. |
| vivo | Agree with Apple. We see both option 1 and option 2 can be supported. They are for different issues. |

### Sub-topic 3-5: release independent

**Issue 3-6: release independent**

* Proposals
	+ Option 1 (CATT, CMCC, Ericsson): Rel-17 NR HST RRM enhancement can be release independent from Rel-15
	+ Option 2 (vivo): The release independent issue is not discussed until the features discussed in R17 FR1 HST becomes stable
* Recommended WF
	+ More discussion is needed

|  |
| --- |
| **Issue 3-6: release independent** |
| **Company** | **Comments** |
| XXX | …. |
| Huawei | Demodulation is discussing the release independent issue in parallel. In our understanding, whether a feature is release independent is supposed to consider all aspects. We suggest to wait for the conclusion from other session. |
| OPPO | Slightly prefer option 2. And share the similar concern from HW. |
| Ericsson | Support option1 but we can keep it open until completion of HST enhancement.  |
| CATT | We support option 1.  |
| CMCC | It is not a good way to mix the discussion between RRM and demod. For RRM session, it is suggested to focus on the discussion from RRM point of view and conclude whether it can be release independent from RRM point of view firstly. Once we have conclusion separately in demodulation session and RRM session, we can further consider whether the whole feature can be release independent from Rel-15 taking the conclusions from both sessions into account. |
| vivo | Option 2 is just to keep this open and can be supported. |

## 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 #3-1 L1-SINR** | **Issue 3-1: L1-SINR***Candidate options:** Option 1 (CMCC, vivo): legacy L1-SINR accuracy requirements can be reused for high speed train scenario, no restriction is needed
* Option 2 (MTK, Ericsson): If RAN4 confirm the L1-SINR measurement will be applied for HST, then the upper bound of the side condition SSB Ês/Iot ≤5 dB should be introduced, for CMR only case at least
* Option 3 (MTK, OPPO, HW, CATT,): Clarify firstly whether L1-SINR measurement requirement is not applicable to HST or not
* Option 4 (Nokia): L1-SINR for CMR only does not seem to face the same side condition problem as SS-SINR

*Recommendations for 2nd round:*This issue includes two questions, suggest to discuss following questions in the 2nd round:Q1: whether L1-SINR measurement is applicable to HSTQ2: If the answer to Q1 is Yes, whether it is necessary to specify upper bound of side condition for L1-SINR measurement |
| **Sub-topic #3-2 SCell link recovery** | **Issue 3-2: SCell link recovery***Candidate options:** Option 1 (CATT, CMCC, vivo, Nokia): For SCell link recovery, it depends on network. There is no need to have the limitation on the number of band(s)in the spec
* Option 2 (MTK): For SCell link recovery, RAN4 needs to study how many band(s) is supported in R17 HST in FR1
* Option 3 (OPPO, HW, Nokia, vivo): The same limitation on the number of band(s) on which UE is performing beam failure detection for SCell in R16 can be reused in R17 HST

*Recommendations for 2nd round:*Continue the discussion |
| **Sub-topic #3-3 CSSF** | **Issue 3-3: CSSF***Candidate options:*Option 1(HW, OPPO, QC, CATT, CMCC, Ericsson, Nokia, vivo): For CSSF, it depends on network. There is no need to have the limitation on the number of Scell (s) in the specOption 2 (MTK): For CSSF, RAN4 needs to study how many SCell(s) is supported in R17 HST in FR1*Recommendations for 2nd round:*Continue the discussion |
| **Sub-topic #3-4 signaling** | **Issue 3-4: UE capability***Candidate options:** Option 1 (OPPO, MTK, Ericsson, QC, vivo): It is optional UE capability to be introduced for supporting HST inter-frequency measurement enhancement, including RRC Connected and Idle state
* Option 2 (CMCC): it is necessary to discuss whether a single UE capability can cover both CA enhancement and inter-frequency measurement enhancement
* Option 2a (HW): separate UE capabilities for CA enhancement and inter-frequency measurement enhancement
* Option 3 (MTK, Ericsson, QC, CMCC): keep it open, finalize the requirement first

*Recommendations for 2nd round:*As mentioned by companies, it is better to finalize the requirement firstly before we have detail discussion on UE capability. Suggest not to further discuss this issue in 2nd round.**Issue 3-5: Network assistant signalling***Candidate options:** Option 1 (CMCC, HW, OPPO, MTK, Nokia, Ericsson, CATT, vivo): it is proposed for RAN4 to further check whether highSpeedMeasFlag-r16 can be reused for the indication of application of enhanced RRM requirements for HST CA
* Option 2 (Apple, vivo): NW shall indicate which inter-frequency layers need to be measured more often, for which enhanced inter-frequency measurement requirements shall apply

*Recommendations for 2nd round:*This issue includes two questions, suggest to discuss following questions in the 2nd round:Q1: whether highSpeedMeasFlag-r16 can be reused for the indication of application of enhanced RRM requirements for HST CAQ2: whether NW shall indicate which inter-frequency layers need to be measured more often, for which enhanced inter-frequency measurement requirements shall apply |
|  | **Status summary**  |
| **Sub-topic #3-5 release independent** | **Issue 3-6: release independent***Candidate options:** Option 1 (CATT, CMCC, Ericsson): Rel-17 NR HST RRM enhancement can be release independent from Rel-15
* Option 2 (vivo, OPPO, Ericsson, vivo): The release independent issue is not discussed until the features discussed in R17 FR1 HST becomes stable
* Option 3 (HW, OPPO): wait for the conclusion from demodulation session

*Recommendations for 2nd round:*Continue the discussion. It is not suggested to mix the discussion between RRM session and demodulation session. Companies are suggested to discuss this issue from RRM point of view. Once we have conclusion separately in demodulation session and RRM session, we can further consider whether the whole feature can be release independent taking the conclusions from both sessions into account. |

### 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)

### Sub-topic 3-1: L1-SINR

**Issue 3-1: whether L1-SINR measurement is applicable to HST**

*Candidate options:*

* Option 1: Yes
* Option 2: No

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 3-1: whether L1-SINR measurement is applicable to HST** |
| **Company** | **Comments** |
| vivo | Option 1.Since the L3 SS-SINR has limited performance, and L3 CSI-SINR only consider timing difference within CP/2, we think it is possible to use L1-SINR. |
| MediaTek | Need operator’s input. |
|  |  |

**Issue 3-2: If the answer to Q1 is Yes, whether it is necessary to specify upper bound of side condition for L1-SINR measurement**

*Candidate options:*

* Option 1 (CMCC, vivo): legacy L1-SINR accuracy requirements can be reused for high speed train scenario, no restriction is needed
* Option 2 (MTK, Ericsson): If RAN4 confirm the L1-SINR measurement will be applied for HST, then the upper bound of the side condition SSB Ês/Iot ≤5 dB should be introduced, for CMR only case at least
* Option 3 (Nokia): L1-SINR for CMR only does not seem to face the same side condition problem as SS-SINR

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 3-2: If the answer to Q1 is Yes, whether it is necessary to specify upper bound of side condition for L1-SINR measurement** |
| **Company** | **Comments** |
| vivo | Option 1CMR-only case is only defined for CSI-RS based measurements, and we do not see the issue of ICI caused by Doppler spread, if the TCI state for CSI-RS measurement is properly configured. |
| MediaTek | Support option2. In our understanding, both L1-SIRN and SS-SINR are facing the same issue. As long as two signals are transmitted from different TRPs, UE will encounter a large frequency offset which leads to ICI.  |
|  |  |

### Sub-topic 3-2: SCell link recovery

**Issue 3-3: SCell link recovery**

*Candidate options:*

* Option 1 (CATT, CMCC, vivo, Nokia): For SCell link recovery, it depends on network. There is no need to have the limitation on the number of band(s)in the spec
* Option 2 (MTK): For SCell link recovery, RAN4 needs to study how many band(s) is supported in R17 HST in FR1
* Option 3 (OPPO, HW, Nokia, vivo): The same limitation on the number of band(s) on which UE is performing beam failure detection for SCell in R16 can be reused in R17 HST

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 3-3: SCell link recovery** |
| **Company** | **Comments** |
| vivo | Fine with option 3. |
| Apple | Open to option 1 and 3. |
| MediaTek | We can compromise to option 1. But we prefer to add a note that UE is allowed to perform beam failure recovery with the same delay with non-HST and NW should guarantee that the UE would not experience beam failure along the railway.The suggested agreement is provided as follows:

|  |
| --- |
| For SCell link recovery, it depends on network. There is no need to have the limitation on the number of band(s)in the spec.* The same requirement of SCell link recovery is applied for non-HST and HST.
* NW should guarantee that UE would not experience link failure along the railway due to increased number of bands.
 |

 |

### Sub-topic 3-3: CSSF

**Issue 3-4: CSSF**

*Candidate options:*

* Option 1(HW, OPPO, QC, CATT, CMCC, Ericsson, Nokia, vivo): For CSSF, it depends on network. There is no need to have the limitation on the number of Scell (s) in the spec
* Option 2 (MTK): For CSSF, RAN4 needs to study how many SCell(s) is supported in R17 HST in FR1

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 3-4: CSSF** |
| **Company** | **Comments** |
| vivo | Support option 1.Regarding comments from MTK in 1st round, as we discussed in the paper, we do not see the necessity for network to configure with a large number of CCs in HST scenario. Anyway RAN4 need only to define requirements and leave the flexibility to network. |
| Apple | Option 1 is OK. Configuring large number of CC would result in long measurement delay on each CC. we think NW can make the decision.  |
| MediaTek | Support option 2. In our understanding, larger CSSF means longer measurement period which is not feasible for HST deployment. It will be strange if we try to minimize the number of samples in Scell measurement period but we allow a large CSSF value to scale up the total measurement delay. |
|  |  |

### Sub-topic 3-4: signalling

**Issue 3-5: whether *highSpeedMeasFlag-r16* can be reused for the indication of application of enhanced RRM requirements for HST CA**

|  |
| --- |
| *Background:**According to TS38.331, highSpeedMeasFlag-r16* is transmitted in RRC IEs *ServingCellConfigCommonSIB* and *ServingCellConfigCommon*. With the IE *ServingCellConfigCommon*, the network provides this information in dedicated signalling when configuring a UE with a SCells or with an additional cell group (SCG). |

*Candidate options:*

* Option 1 (CMCC, HW, OPPO, MTK, Nokia, Ericsson, CATT, vivo): Yes, the highSpeedMeasFlag-r16 can be reused for the indication of application of enhanced RRM requirements for HST CA

Recommended WF

* Companies are encouraged to check whether option 1 is agreeable.

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| --- |
| **Issue 3-5: whether *highSpeedMeasFlag-r16* can be reused for the indication of application of enhanced RRM requirements for HST CA** |
| **Company** | **Comments** |
| vivo | Option 1 is agreeable. |
| Apple | Even though option 1 is feasible, e.g. new requirement applies to UE with new capability supported but under control of same NW flag, we prefer to have separate flags corresponding to separated enhancement. One example in R16 history is that RAN4 agreed to use one flag to control both intra-NR and inter-RAT NR-LTE HST at beginning. However, some issues were identified later such that clarification needs to be introduced. |
| MediaTek | Agree with Option 1. |

**Issue 3-6: whether NW shall indicate which inter-frequency layers need to be measured more often, for which enhanced inter-frequency measurement requirements shall apply**

*Candidate options:*

* Option 1 (Apple, vivo): NW shall indicate which inter-frequency layers need to be measured more often, for which enhanced inter-frequency measurement requirements shall apply

Recommended WF

* Continue the discussion

|  |
| --- |
| **Issue 3-6: whether NW shall indicate which inter-frequency layers need to be measured more often, for which enhanced inter-frequency measurement requirements shall apply** |
| **Company** | **Comments** |
| vivo | Support option 1 at least for idle mode.For connected mode, it is up to network how the MOs are configured. Generally ok with the proposal but may need more time to check. Can be FFS. |
| Apple | Support option 1. This is in line with issue 2-5. |
| MediaTek | More discussion is needed.One question for clarification: Which scenario is considered for this issue, i.e., IDLE mode or CONNECTED mode? |

### Sub-topic 3-5: release independent

**Issue 3-7: release independent**

*Candidate options:*

* Option 1 (CATT, CMCC, Ericsson): Rel-17 NR HST RRM enhancement can be release independent from Rel-15
* Option 2 (vivo, OPPO, Ericsson): The release independent issue is not discussed until the features discussed in R17 FR1 HST becomes stable

Recommended WF

* Continue the discussion. Companies are suggested to discuss this issue from RRM point of view. Once we have conclusion separately in demodulation session and RRM session, we can further consider whether the whole feature can be release independent taking the conclusions from both sessions into account.

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| **Issue 3-7: release independent** |
| **Company** | **Comments** |
| vivo | Prefer option 2. |
|  |   |
|  |  |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on RRM for FR1 HST | CMCC |  |
|  |  |  |

**Existing tdocs**

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