**3GPP TSG-RAN WG4 Meeting # 102-e (Draft)** **R4-2207053**

**Electronic Meeting, February 21 – March 3, 2022**

**Agenda item:** 10.9.3

**Source:** Moderator (Nokia, Nokia Shanghai Bell)

**Title:** Email discussion summary for [102-e][212] NR\_HST\_FR2\_RRM\_1

**Document for:** Approval

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

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

* 1st round: TBA
* 2nd round: TBA

## Background and scope

This T-doc will be used to guide and summarize the email discussion for the topic of Rel-17 NR HST FR2 enhancements RRM core requirements, with the email thread identifier “[102-e][212] NR\_HST\_FR2\_RRM\_1”.

In this email thread, the following agenda items are discussed:

* 10.9.4 RRM core requirements
	+ 10.9.3.1 General
	+ 10.9.3.2 RRC Idle/Inactive and connected state mobility requirements
	+ 10.9.3.4 Signalling characteristics requirements
	+ 10.9.3.5 Measurement procedure requirements

The following WFs were approved previously:

* R4-2103679, WF on Rel-17 NR HST FR2 enhancements, RRM requirements, Nokia, Nokia Shanghai Bell, RAN4#98-e.
* R4-2105794, WF on FR2 HST RRM requirements, Nokia, Nokia Shanghai Bell, RAN4#98-bis-e.
* R4-2115334, WF on FR2 HST RRM requirements (part 1), Nokia, Nokia Shanghai Bell, RAN4#100-e.
* R4-2115335, WF on FR2 HST RRM requirements (part 2), Samsung, RAN4#100-e.
* R4-2120292, WF on FR2 HST RRM requirements (part 1), Nokia, Nokia Shanghai Bell, RAN4#101-e.
* R4-2120416, WF on FR2 HST RRM requirements (part 2), Samsung, RAN4#101-e.
* R4-2202594, WF on FR2 HST RRM (part 1), Nokia, Nokia Shanghai Bell, RAN4#101-bis-e.
* R4-2202767, WF on FR2 HST RRM (part 2), Samsung, RAN4#101-bis-e.

As a moderator for FR2 HST enhancements RRM discussion, we would like to suggest the following candidate target of 1st and 2nd round email discussion:

* 1st round:
	+ Converge in the most critical open issues, such as 1-1-1 Lightweight network assisting signaling, 2-2-1, Time period for PSS/SSS detection, 2-3-2 Interference at TCI switching.
	+ Collect comments on the draft CRs so that they could be revised in the most efficient way in the 2nd round.
* 2nd round:
	+ Achieve agreements on the open issues as much as possible since it is the last RAN4 meeting on NR\_HST\_FR2\_Core requirements.
	+ Endorse as many draftCRs as possible to combine those in the bigCR for the post-meeting endorsement.

## Email discussion guidelines

The moderator would like to ask companies to adhere to the following guidelines, when taking part in [102-e][212] NR\_HST\_FR2\_RRM\_1.

Please also check the “RAN4#102-e meeting arrangements and guidelines”, available on the reflector, for fundamental guidelines and deadlines.

The preferred method of commenting is to add/update your company’s view directly in this email summary document (use change marks whenever appropriate) and upload it to [102 -e][212] NR\_HST\_FR2\_RRM\_1 draft folder corresponding to the stage of the meeting, e.g., pre-meeting, first round, second round.

* Draft folder:
[[102 -e][212] NR\_HST\_FR2\_RRM\_1](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1)
<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1>
* It is expected that delegates will download the latest version (including other companies’ versions) of the summary document, insert comments and upload it again.
* To ensure the comments are captured timely and correctly, delegates are encouraged to:
	+ Rename the file by adding your company name and changing the file version.
	Example: “Summary\_212\_HST\_FR2\_RRM\_1\_v0\_1st\_round\_**v05\_CATT\_Nokia**.docx” -> “Summary\_212\_HST\_FR2\_RRM\_1\_v0\_1st\_round\_**v06\_Nokia\_QC**.docx”
	+ There is no need to send e-mails in the reflector when comments in the summary are added.
	+ Please, check for updated base document versions, right before uploading your updates.
* Please, do not hesitate to mark your company as supporting a certain option directly in this document.
Please refrain from rewriting existing options and proposed WFs; ask the moderator (in your company’s comment) to modify/add.
* It is encouraged to give a short reasoning for each view expressed (1-2 sentences are recommended).
Please avoid statements like “Option X”, without further explication or reasoning.
* **Please, update your company contact information in the Annex.**It is also recommended to explicitly mention delegate’s name next to company name in the comments if multiple delegates from the same company are commenting.
An alternative way is to identify different delegates in the Track changes username.

# Topic #1: General

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2203711 | Qualcomm, Inc. | **On NR FR2 HST RRM Requirements****Proposal 1**: Capture the following description of set 1 requirements applicability in TR: When 2Rx beam sweep based requirement (set 1) applies to the deployment scenario with Dmin > 10m or Hdiff (height difference between train rooftop mounted CPE and RRH) > 10m, performance degradation is expected. **Proposal 2**: Add a MAC-CE command to inform UE of the TCI state switch is across RRH and send an LS to RAN2. [Moderator]: Observation 1 – Observations 3 below shall be treated in RRM-2.**Observation 1**: The proposed aperiodic L1-RSRP request can prevent false alarm and miss detection in large DL timing detection by enabling UE to use the updated SSB timing from the latest SSB occasion instead of stale SSB timing from SSB detection. **Observation 2**: The aperiodic L1-RSRP report approach for enabling large timing adjustment is more efficient than RACH procedure from throughput impact and network/UE implementation perspective. **Proposal 3**: Apply the following procedure to cross-RRH TCI state switch: * Network schedules an aperiodic L1-RSRP report to trigger DL timing difference detection before cross-RRH TCI state switch.
* RAN4 imposes UL and DL scheduling restriction after cross-RRH TCI state switch before first TRS reception. UE performs the large UL timing adjustment on the first UL transmission after the first TRS reception, and this timing adjustment is allowed to exceed the Tq requirement in 38.133 clause 7.1.2.1.

The text proposal for capturing the above procedure in RAN4 spec is in draft CR[4]. **Observation 3**: Propagation delay difference between two RRHs can cause large UL to DL interference when two UEs are close two each other and an RRH. **Proposal 4**: Network applies different offsets to DL frame boundaries of different RRHs to pre-compensate the propagation delay difference across different RRHs to eliminate UL to DL interference across UEs. Network then inform UE the TA change needed after TCI state change across RRHs.[Moderator]: Proposal and observation below are treated in Topic#2.**Observation 4**: The additional pathloss for option 2 (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps =24) is within 5dB and SINR is kept above 10dB during the cell identification time, which is more than sufficient to maintain connection. **Proposal 5**: For FR2 HST neighboring cell search enhancement, set scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 10 for Set 1 and 24 for Set 2. **Proposal 6**: Introduce a UE capability for one shot large UL timing adjustment.**LS Draft (TCI State Switch Across RRHs)** |
| R4-2203714 | Qualcomm, Inc. | **TP to TR 38.854 on the Number of Rx beams** |
| R4-2203898 | CATT | **Discussion on general issues for FR2 HST****Proposal 1**: We slightly prefer to have the network assisted signalling of SSB index and order per RRH, if Rel-17 schedule is allowed. **Proposal 2**: Power class shall be used to identify the feature support. From RRM perspective, Per-UE type is enough. But for RF and demod feature, it depends on conclusion from other session. |
| R4-2204715 | Ericsson | **General requirements for HST FR2****Proposal 1**: Only list or highlight benchmark of performance obtained when Dmin = [10] m, but don’t note performance difference or degradation when Dmin > [10] m. **Proposal 2**: Support Option 3: Introduce inter-RRH indication, because of easy implementation. **Proposal 3**: In Rel-17, Configure a different mobility parameter, e.g., offset in HO and BM for opposite direction to abbreviate SNR drop duration. Further enhancement can be studied in next release. **Proposal 4**: Power class can be used to identify the feature support at least in Rel17. **Proposal 5**: Because the UE type in FR2 HST scenario only comprises FR2 CPE type, per UE is enough. |
| R4-2204720 | Ericsson | **LS on network signalling for Rel-17 NR HST RRM** |
| R4-2204721 | Ericsson | **draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM** |
| R4-2205008 | ZTE Corporation | **General RRM requirements for HST FR2****Proposal 1**: The applicability restriction of 2 Rx beam requirements is necessary. For the detailed range of Dmin, a typical value such as no larger than 50 m can guarantee no significant performance degradation. **Proposal 2**: If only starting from RRM-1, we can not see strong request to introduce network assisted signalling. However in order to address the large propagation delay difference issue in RRM-2, we prefer Option 3 since the Uni-directional and bi-directional deployment flag has been approved. **Proposal 3**: The inter-RRH indication should keep consistent with active TCI state switching indication. Adding 1 bit to differentiate whether inter-RRH happening on top of the RRC signaling/MAC CE/DCI based active TCI state switching. |
| R4-2205895 | Samsung | **Discussion on capability and feature list for FR2 HST UE****Proposal 1**: FR2 HST relevant feature(s) should be per-band type. **Proposal 2**: “Support of one shot large UL timing adjustment” can be listed as another feature from “Support of FR2 HST operation”. **Proposal 3**: For one shot large UL timing adjustment, it is proposed that the feature is mandatorily supported with capability signaling. Accordingly, the feature list components for FR2 HST UE is provided in Table 1.  |
| R4-2205896 | Nokia, Nokia Shanghai Bell | TP to TR 38.854 – beam coverage for FR2 HST |
| R4-2205900 | Nokia, Nokia Shanghai Bell | **Link simulation assumptions for L1 and L3 measurement accuracy for FR2 HST scenarios**For L3 measurement accuracy, the CDF curves to be provided are as follows: Delta SS-RSRP   = (estimated SS-RSRP – ideal SS-RSRP) [dB]   Delta SS-RSRQ   = (estimated SS-RSRQ – ideal SS-RSRQ) [dB]   Delta SS-SINR   = (estimated SS-SINR – ideal SS-SINR) [dB]   For L1 measurement accuracy, the CDF curves to be provided are as follows: Delta L1-RSRP   = (estimated L1-RSRP – ideal L1-RSRP) [dB]     Delta L1-SINR   = (estimated L1-SINR – ideal L1-SINR) [dB]    |
| R4-2206008 | Intel Corporation | **Discussion on applicability of enhanced requirements for HST in FR2****Proposal 1**: RAN4 will not capture any strict deployment limitations for enhanced RRM requirements applicability. |

## 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 1-1: General

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

#### Issue 1-1-1: Lightweight network assistance signaling

* Background

At the previous RAN4#101-bis-e meeting no agreement was achieved on the need an type of network assistance signaling:

|  |
| --- |
| **Way forward:**Discuss further which NWA signaling is needed:* Option 1: Enable network assisted signaling of SSB index and order per RRH.
* Option 2: The network assistance signaling of SSB configuration shall not be introduced in Rel-17.
* Option 3: Introduce inter-RRH indication
* Option 4: Other options are not precluded
 |

Below proposals on signaling submitted to RRM-2 email discussion thread on larger one-shot UL timing adjustment are listed:

* R4- 2203754 by Apple:
	+ Proposal 1: Enable light weight inter-RRH signaling to UE.
	+ Proposal 2: Support network assisted information, i.e., enable network assisted signaling of SSB index and order per RRH.  For example:
		- The signaling can reuse current SSB signaling by reinterpretation of the bit field when FR2 HST deployment flag is set.
		- Group represent RRH, max 8 RRH per cell. SSB index is in order along the track.
		- No additional signaling overhead.
	+ Proposal 3: RAN4 can determine max number of RRH per cell supported in SIB1 signaling and leave detailed signaling design to RAN2.
* R4-2205959, by Nokia:
	+ Observation: Network signalling indicating inter-RRH TCI state switch to the UE can be beneficial to mitigate UL transmit timing error that appears due to a need to synchronize to the target beam in the case of intra-RRH TCI state switch.
	+ Proposal: RAN4 to introduce lightweight network signaling for the indication of inter-RRH TCI state switch to the UE, e.g., in the form of the one-bit flag in the TCI state switch command.
* Proposals and/or Observations
	+ Proposal 1 (QC): Add a MAC-CE command to inform UE of the TCI state switch is across RRH and send an LS to RAN2.
	+ Proposal 2 (CATT): We slightly prefer to have the network assisted signalling of SSB index and order per RRH, if Rel-17 schedule is allowed.
	+ Proposal 3 (Ericsson): Support Option 3: Introduce inter-RRH indication, because of easy implementation.
	+ Proposal 3 (ZTE): If only starting from RRM-1, we can not see strong request to introduce network assisted signalling. However in order to address the large propagation delay difference issue in RRM-2, we prefer Option 3 since the Uni-directional and bi-directional deployment flag has been approved.
	+ Proposal 4 (ZTE): The inter-RRH indication should keep consistent with active TCI state switching indication. Adding 1 bit to differentiate whether inter-RRH happening on top of the RRC signaling/MAC CE/DCI based active TCI state switching.
* Candidate options:
	+ Option 1 (CATT, QC): Enable network assisted signaling of SSB index and order per RRH
	+ Option 3a (QC, Ericsson, ZTE): Introduce inter-RRH indication in TCI state switch MAC CE
	+ Option 3b (ZTE): Introduce inter-RRH indication in TCI state switch RRC signaling/MAC CE/DCI
* Recommended WF
	+ Companies are encouraged to identify acceptable signaling types to converge to a single option in the 1st round.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson  | We support Option1. It benefits several issues under discussions and practical implementation, not only timing adjustment. Signaling of SSB index and order per RRH can help UE to utilize spatial characteristics of SSBs.Opiton3a or 3b can be fallback solution if overhead of SSB index signaling is questionable.  |
| Intel | We prefer not to have network assisted signaling, since we consider it as an enhancement and the system can work without it. However, for the sake of WI progress we can compromise if the group will decide that the signaling is still necessary.Our preferences are prioritized in the following order:1. No to have network assisted signaling
2. Option 1
3. Option 3a
 |
| Moderator | The following agreement was achieved at the GtW session:* Agreements
	+ Inter-RRH indication
		- Do not introduce explicit inter-RRH indication signalling for NR FR2 HST in Rel-17
		- FR2 HST Inter-RRH indication signalling enancements can be considered in Rel-18 subject to RAN plenary decision
	+ FFS whether additional assumptions for the definition one shot UL timing adjustment requirements shall be introduced (e.g. UE is configured with aperiodic L1-RSRP reporting before the TCI state switch, or UE performed fine time tracking within X ms before/after TCI state switching)

Moderator’s recommendation is to discontinue further discussion of the issue. |

#### Issue 1-1-2: LS on network signaling to RAN2

* Background

Two LS on network signaling to RAN4 were submitted to the meeting

* + LS Draft (TCI State Switch Across RRHs) in the appendix of R4-2203711 by Qualcomm
		- The signaling methods include but not limited to either RRC based signaling which indicates the set of SSB index and order along the track belongs to each RRH, or through dynamic signaling via MAC-CE comes with TCI state switch.
	+ [Draft] LS on network signalling for Rel-17 NR HST RRM, R4-2204720, by Ericsson.
		- Signalling to inform the UE that a TCI state switch is across RRH.
* Recommended WF
	+ The preparation of the LS should be based on the discussion and agreement in the previous issue.
	+ The companies are still invited to share their opinions about which of the LSs could be used as a baseline.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We’re fine with either of LS based on agreements on Issue 1-1-1. |
| Intel | Prefer to discuss the Issue after an agreement on Issue 1-1-1. |
| Moderator | Following the GtW agreement:* + - FR2 HST Inter-RRH indication signalling enancements can be considered in Rel-18 subject to RAN plenary decision

There is no need in the LS and it is recommended to discontinue the discussion in the issue. |

#### Issue 1-1-3: Applicability of enhanced Set-1 RRM requirements

* Background

At RAN4#101-bis-e the following WF was agreed [R4-2202594]:

|  |
| --- |
| **Way forward:*** FFS, whether it should be clarified in the TR that 2Rx beam sweep based requirement (set 1) applies to the deployment scenario with Dmin > [10] m or Hdiff (height difference between train rooftop mounted CPE and RRH) > [10] m, performance degradation is expected.
* The proponents are encouraged to bring a TP to the TR, where the discussion can focus on the TP.
 |

* Proposals
	+ Proposal 1 (QC): Capture the following description of set 1 requirements applicability in TR:
	When 2Rx beam sweep based requirement (set 1) applies to the deployment scenario with Dmin > 10m or Hdiff (height difference between train rooftop mounted CPE and RRH) > 10m, performance degradation is expected.
	+ Proposal 2 (Ericsson): Only list or highlight benchmark of performance obtained when Dmin = [10] m, but don’t note performance difference or degradation when Dmin > [10] m.
	+ Proposal 3 (ZTE): The applicability restriction of 2 Rx beam requirements is necessary. For the detailed range of Dmin, a typical value such as no larger than 50 m can guarantee no significant performance degradation.
	+ Proposal 4 (Intel): RAN4 will not capture any strict deployment limitations for enhanced RRM requirements applicability.
* Recommended WF
	+ Discuss the proposals in 1st first round.
	+ In the 1st round, it is recommended to focused on this issue rather than on the TP itself (R4-2203714 in Section 1.2.3).

Companies’ views collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Support proposal 2. We don’t need to specify any/all performance deviation compared to [10]m. Practical performance degradation may rely on antenna configurations, angles and etc. which are configurable. At the most, a note, such as ‘performance deviation is expected when Dmin> [10] m’, can be added in TR. |
| Intel | Support Proposals 2 and 4. If the group will decide that the recommendation on applicability of 2 Rx beam requirements is still necessary then we can compromise to Proposal 3, which is generally aligned with our observations. |
| QC | We support proposal, if the performance wording is a concern, we propose the following alternative:Set 1 requirements are developed based on Dmin = 10m analysis, and recommended application range is Dmin <= [10]m. For large Dmin, Set 2 requirements are recommended. For 10m vs 50m discussion:The following figure is from Intel’s contribution. The argument is both 10m and 50m can support 64QAM. Set aside whether the environment noise assumption is accurate to derive the SNR, we can see a large SNR difference when UE is 0 to 200m away from RRH between Dmin = 10m and Dmin = 50m. This is mainly due to the limited number of beams available and UE is not able to receive data from nearby RRH, and has to rely on far away RRH to serve it. When we consider more beams as in set 2, in Dmin = 50m case we can achieve similar performance as Dmin = 10m with set 1. We plot the difference between SNR of set 1 and set 2 in 50m, which aligns with the Dmin = 10m to Dmin = 50m difference as Intel’s plot.Therefore, we consider the applicability range smaller than 50m, but where to go down to 10m, we are open to discuss and can provide analysis when companies propose other numbers. |
| ZTE | We support Proposals 2, 3 and QC’s alternative wording above. We believe listing the deployment suggestion is make sense due to a large space really existing between 10 m and 150 m. But not any performance degradation should be referred to since actually the possible performance degradation relates to many factors, such as cited by Ericsson, which are configurable. |
| Apple | Support proposal 2 and 4.  |
| Samsung | The applicability rule in TS38.133 is not necessary, because it is always up to NW to decide which configuration shall be used in deployment. As agreed in last meeting, the discussion here shall be restricted to capture the logic or background for how RAN4 derive the requirement in TR38.854. From that perspective, we recommend the following alternative to be captured in TR, which is based on QC’s newly proposed alternative: “Set 1 requirements are developed based on the analysis with Dmin = 10m and Ds = 750m, and recommended applicable range of Dmin for Set 1 requirement is Dmin <= [50] m. For the deployment with larger Dmin, Set 2 requirements are recommended to be configured by network.” |
| QC | We can support Samsung’s wording, and regarding the Dmin threshold, we did further analysis on 30m and 40m:When Dmin = 40m, the tput difference is 15%, and Dmin = 30m, the tput difference is 9%, between set 1 and set 2 requirements. Given the analysis result, we consider 30m as good threshold as the tput difference is within 10%. Note that Dmin = 50m has 20% throughput degradation. |

#### Issue 1-1-4: Train travelling opposite to the serving beam

* Background

At RAN4#101-bis-e the following WF was agreed [R4-2202594]:

|  |
| --- |
| **Agreement:**The DRX upper bound = 80 ms applies both to Sets 1 (Scenario-A) and 2 (Scenario-B).**Way forward:*** The companies are encouraged to provide the analysis of Scenario-A where the train is travelling in the direction opposite to the serving beam orientation in the TR.
 |

* Proposals:
	+ Proposal 1 (Ericsson): In Rel-17, Configure a different mobility parameter, e.g., offset in HO and BM for opposite direction to abbreviate SNR drop duration. Further enhancement can be studied in next release.
* Recommended WF
	+ Discuss the proposal in the 1st round.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We think that proper configurations in beam management can mitigate the issue also, similar to offset configurations in HO. |
| QC | Proposal 1 seems to be base station implementation resolution, if it doesn’t have spec impact, we don’t oppose it. |
| ZTE | We have proposed the similar view as Ericsson in our previous documents. To resolve the handover issue for the case of opposite direction moving, configuring a different offset value in the same trigger event is a simple solution.It really seems some base station implementation, without spec impact. |
| CATT | P1 is fine for us. When we discussed the potential mobility issue when the train is travelling direction is opposite to the serving beam orientation in previous meetings, it can be resolved by using proper event offset in NW. In this release, no spec impact of core part.  |
| Apple | Agree this is implementation solution.  |
| Samsung | We would like to know how this proposal would impact the specification and/or TR38.854. Our understanding is there will be at least no impact on the specification for Rel-17. If that is the common understanding, we are okay with the proposal’s former part: “In Rel-17, Configure a different mobility parameter, e.g., offset in HO and BM for opposite direction to abbreviate SNR drop duration.”For next release, the scope needs to be and is still under discussion in RAN plenary, and we see no necessity to have “Further enhancement can be studied in next release.”, except the proponent can give a clear objective (agreeable to the group) which is ready to be captured in Rel-18 WID. |
| Nokia | The same problem exists for inter-RRH beam switching. As compared with mobility, it is worse for beam switching because there are no equivalent offset configurations, CHO, etc. We do not know if a base station implementation approach can solve the open issue. Therefore, we are interested to hear from proponents/companies who suggest that base station implementation can resolve the open issue. Please elaborate on how base station implementation can resolve.  |

#### Issue 1-1-5: Link simulation assumptions for L1 and L3 measurement accuracy

* Background

One of the companies have brought link simulation assumptions for L1 and L3 measurement accuracy for FR2 HST scenarios [R4-2205900]:

**L3 simulation assumptions**

In the simulation, two cells are considered, which are Cell 1 (serves as an interfering cell and unknown to UE) and Cell 2 (serves as the cell under measurement and known to UE).

Table 1: General parameters

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Carrier frequency for Cell 1 and Cell 2 | 30 GHz |
| DRX | No |
| RRH transmit antenna configuration for SS blocks | 1 tx or single layer transmissions |
| UE receive antenna configuration | 2 rx  |
| Data and control channel subcarrier spacing | SSB SCS 240 kHz/120 kHz, data SCS 120 kHz |
| Measurement period (in number of measurement samples) | 5 (other values should be considered such as 1 and 3) |
| * Subcarrier spacing SSB
 | 240 kHz/120 kHz |
| * Number of SS blocks per SS burst set, K
 | 1 up to 8 is possible (a subset can be used) |
| * SS burst periodicity
 | 5 ms and other values, e.g., 10ms, 20 ms |

Table 2: Cell-specific parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| NR RF Channel number | - | Channel 1 | Channel 1 |
| NR-PSS and NR-SSS sequences | - | To be indicated by companies | To be indicated by companies |
| PBCH and DMRS power offset with respect to NR-PSS and NR-SSS | dB | 0 | 0 |
| Data and control PSD relative to NR-PSS and NR-SSS | dB | 0 | 0 |
| RB Utilization | % | 100 | 100 |
| Data Modulation | - | QPSK | QPSK |
| Slot length | - | 14 symbols | 14 symbols |
| CP Length | - | Normal | Normal |
| Frequency Offset relative to UE frequency reference | Hz | 0 | 0 |
| 1)Relative Delay of 1st Path (synchronous) | µs | 0 | [CP/2] |
| Es/IoT  | dB | 6.4 | 1.25; FSS: -0.75, 0.25; (SINR: -6dB; FFS: -8dB, -7dB) |
| Propagation conditions | - | AWGN with 9722 Hz offset between desired and interfering cells for uni-directional Scenario A and bi-directional Scenario B |

**L1 simulation assumptions**

In the simulation, one cell is considered.

Table 3: General parameters

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Carrier frequency for Cell 1 | 30 GHz |
| channel | AWGN |
| BS transmit antenna configuration | 1 tx |
| UE receive antenna configuration | 2 rx |
| Subcarrier spacing | 120 kHz |
| Carrier frequency offset | 9722 Hz for uni-directional Scenario A and bi-directional Scenario B |
| Frequency tracking | TRS with periodicity = 10 ms |

Table 4: L1-SINR accuracy evaluation simulation assumptions for CMR only

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Data channel subcarrier spacing | The same as CSI-RS subcarrier spacing |
| Measurement period (in number of measurement samples) | 1 sample |
| CSI-RS periodicity | 80 slots |
| Number of PRBs | 48 |
| Density | 3 |
| Side condition (SNR) on CMR | -3 dB |

The simulation assumptions in Table 4 are also applicable to SSB and CSI-RS based L1-RSRP accuracy evaluation.

Table 5: L1-SINR accuracy evaluation simulation assumptions for SSB-based CMR + NZP-IMR

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Data channel subcarrier spacing | The same as SSB and CSI-RS subcarrier spacing |
| Measurement period (in number of measurement samples) for CMR/IMR | 1 sample |
| Channel measurement resource (CMR) | SSB |
| Interference measurement resource (IMR) configuration | CSI-RS |
| periodicity | CMR periodicity (80 slots) = IMR periodicity |
| Ideal SINR | -3dB |
| Number of PRBs for IMR | 48 |
| Density for IMR | 3 |
| Side condition (SNR) on CMR | 0 dB |
| Side condition (SNR) on IMR | 0 dB |

Table 6: L1-SINR accuracy evaluation simulation assumptions for SSB-based CMR + ZP-IMR

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Data channel subcarrier spacing | The same as SSB and CSI-RS subcarrier spacing |
| Measurement period (in number of measurement samples) for CMR/IMR | 1 sample |
| Channel measurement resource (CMR) | SSB |
| Interference measurement resource (IMR) configuration | CSI-RS |
| periodicity | CMR periodicity (80 slots) = IMR periodicity |
| Ideal SINR | -3dB |
| Number of PRBs for IMR | 48 |
| Density for IMR | 3 |
| Side condition (SNR) on CMR | -3 dB |
| Side condition (SNR) on IMR | N/A |

Table 7: L1-SINR accuracy evaluation simulation assumptions for CSI-RS-based CMR + NZP-IMR

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Data channel subcarrier spacing | The same as SSB and CSI-RS subcarrier spacing |
| Measurement period (in number of measurement samples) for CMR/IMR | 1 sample |
| Channel measurement resource (CMR) | CSI-RS |
| Interference measurement resource (IMR) configuration | CSI-RS |
| periodicity | CMR periodicity (80 slots) = IMR periodicity |
| Ideal SINR | -3dB |
| Number of PRBs for IMR | 48 |
| Density for CMR/IMR | 3 |
| Side condition (SNR) on CMR | 0 dB |
| Side condition (SNR) on IMR | 0 dB |

Table 8: L1-SINR accuracy evaluation simulation assumptions for CSI-RS-based CMR + ZP-IMR

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Data channel subcarrier spacing | The same as SSB and CSI-RS subcarrier spacing |
| Measurement period (in number of measurement samples) for CMR/IMR | 1 sample |
| Channel measurement resource (CMR) | CSI-RS |
| Interference measurement resource (IMR) configuration | CSI-RS |
| periodicity | CMR periodicity (80 slots) = IMR periodicity |
| Ideal SINR | -3dB |
| Number of PRBs for IMR | 48 |
| Density for CMR/IMR | 3 |
| Side condition (SNR) on CMR | -3 dB |
| Side condition (SNR) on IMR | N/A |

* Proposal
	+ For L3 measurement accuracy, the CDF curves to be provided are as follows:
	+ Delta SS-RSRP = (estimated SS-RSRP – ideal SS-RSRP) [dB]
	+ Delta SS-RSRQ = (estimated SS-RSRQ – ideal SS-RSRQ) [dB]
	+ Delta SS-SINR = (estimated SS-SINR – ideal SS-SINR) [dB]
	+ For L1 measurement accuracy, the CDF curves to be provided are as follows:
	+ Delta L1-RSRP = (estimated L1-RSRP – ideal L1-RSRP) [dB]
	+ Delta L1-SINR = (estimated L1-SINR – ideal L1-SINR) [dB]
* Recommended WF
	+ It is recommended to postpone the discussion of L1 and L3 measurement accuracy and focus on the HST FR2 core requirements at this meeting.
	+ In the 1st round, early comments can be provided by the interested companies.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | The assumption looks fine. |
| Intel | Prefer to focus on core requirements first |
| QC | It’s not obvious that why accuracy requirement simulations are needed. In FR1 HST we already concluded that high speed channel has no impact on RSRP measurement requirement, and the only change requires discussion is L1-SINR measurement applicability range. Therefore, we don’t think the discussion is necessary even in performance stage. |
| CATT | Support Recommended WF. |
| Apple | Support the WF |
| Samsung | In general, we support the WF that measurement accuracy can be discussion in performance part of WI. For detailed simulation assumption, below is our comment: - For L3 measurement, “9722 Hz for uni-directional Scenario A and bi-directional Scenario B”, 9722 Hz frequency difference is okay, but here for measurement accuracy simulation, how the performance differs under uni-directional Scn-A and bi-directional Scn-B? If not, no need to metion “for uni-directional Scenario A and bi-directional Scenario B”. - Strictly speaking, “CSI-IM” shall be used for ZP-IMR, so “CSI-RS” in the corresponding tables for ZP-IMR shall be replaced by “CSI-IM”. |
| Nokia | The intention is to reach an agreement on a common set of simulation assumptions so that interested companies can bring their simulation results to the next meeting as time is limited to complete this WI. The suggestions made by Samsung are fine with us. In response to QC’s comments, simulations in the FR1 HST work were performed for frequency FR1 not FR2. So, there is no technical evidence to suggest that the conclusion of FR1 HST for RSRP is directly applicable to FR2 HST. We propose to modify the simulation assumptions to take into account the feedback from different companies for further discussions in the second round.  |

### Sub-topic 1-2: UE capabilities and features

*Sub-topic description*

The following UE features were discussed for the Rel-17 NR FR2 HST WI at RAN4#101-bis-e:



Component (2) “Support of enhanced RRM requirements for FR2 HST” is relevant to HST FR2 RRM.

*Open issues and candidate options before e-meeting:*

#### Issue 1-2-1: Type definition for HST FR2 RRM features

* Proposals and/or Observations:
	+ Proposal 1 (Ericsson): Because the UE type in FR2 HST scenario only comprises FR2 CPE type, per UE is enough.
	+ Proposal 3 (CATT): Power class shall be used to identify the feature support. From RRM perspective, Per-UE type is enough. But for RF and demod feature, it depends on conclusion from other session.
	+ Proposal 2 (Samsung): FR2 HST relevant feature(s) should be per-band type.
* Candidate options:
	+ Option 1(Ericsson, CATT): Per UE
	+ Option 2 (Samsung): Per Band
* Recommended WF:
	+ Collect companies’ views in the 1st round.
	+ It is recommended to focus on RRM features.
* GtW agreement:
* Agreement:
	+ The following UE feature list description for feature “x-1 Support of FR2 HST operation” is endorsed in the RRM session. Further confirmation in the RAN4 Main and Demod session is required.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | Consequence if the feature is not ignalin by the UE | Type | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| x-1 | Support of FR2 HST operation | 1) Support of FR2 UE PC62) Support of enhanced RRM requirements for FR2 HST (except the requirement for one shot large UL timing adjustment)3) Support of demodulation processing for FR2 HST  | [R15 RAN4 feature group:Support of FR2 UE power class 6] | Yes | No | UE does not meet FR2 high speed train scenario | Per Band | No | Applicable to FR2 only | N/A | FR2 UE power class PC6 signalling is used to indicate support of feature group | Optional with capability signaling |

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Per-UE is enough for Rel17. But we’re open to the question in case of other foreseeable possibilities in the future. |
| Intel | Option 2 |
| Huawei | Support option 2. Although from RRM perspective, per UE is fine, the RF requirements shall distinguish different band. UE can support FR2 HST and satisfy RF requirements on certain band, but not on other bands. We think supporting FR2 HST capability shall considers RF, RRM and demodulation together. |
| Moderator | It is recommended to follow the GtW agreement above and to discontinue the discussion of the feature “x-1 Support of FR2 HST operation”. |
| Samsung | As discussed during GTW, we agree that the yellow-highlighted “[R15 RAN4 feature group:Support of FR2 UE power class 6]” in prerequisite feature group should be removed.  |

#### Issue 1-2-2: Capability for one shot large UL timing adjustment

* Background
	+ At RAN4#101-e it was agreed [R4-2120416]:
	“Introduce a mechanism for one shot large uplink timing adjustment for FR2 HST scenarios with UE allowed to adjust uplink timing beyond Tq.”
	+ At RAN4#101-bis-e it was additionally agreed [R4-2202767]:
	“Dedicated new RRC based network ignaling flag will be specified to enable/disable one shot large UL timing adjustment
	+ One of the companies is proposing to use the table below to define the new feature group:



* Proposals and/or Observations
	+ Proposal 1(QC): Introduce a UE capability for one shot large UL timing adjustment.
	+ Proposal 2 (Samsung): “Support of one shot large UL timing adjustment” can be listed as another feature from “Support of FR2 HST operation”.
	+ Proposal 3 (Samsung): For one shot large UL timing adjustment, it is proposed that the feature is mandatorily supported with capability signaling.
* Candidate options:
	+ Option 1: Introduce a new feature group and capability for one shot large UL timing adjustment) as mandatory with capability signaling.
	+ Option 2: Introduce a new feature group and capability for one shot large UL timing adjustment) as optional with capability signaling
	+ Other Options are not precluded
* Recommended WF
	+ Companies are invited discuss candidate options in the 1st round.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | One shot large UL timing adjustment is mandatory to FR2 CPE for HST. If no UE capability for one shot large UL timing adjustment, what will be the effect caused?* + Thus, we prefer Proposal 2 (Samsung): “Support of one shot large UL timing adjustment” can be listed as another feature from “Support of FR2 HST operation”.
 |
| Intel | Support Option 1Two comments for the proposed Table 1:* For x-1 consider removing prerequisite feature group since Support of FR2 UE power class 6 is x-1 feature group component
* For x-2 consider adding prerequisite feature group (x-1) since one shot large UL timing adjustment is applicable only to PC6 Ues.
 |
| QC | We propose to have the capability as optional.To Ericsson: when UE can’t support one shot timing adjustment, network can use RA mechanism.Question to proposal 3: since network as RA mechanism as an option, why we should make this feature mandatory? The system still can operate without support of this feature, RA can be a replacement. |
| CATT | Support option 1.  |
| Apple | Support option 2 as optional. Also for inter-RRH TCI state switching, whether UE can start PDCCH/PDSCH receiving without additional SSB receiving can be an UE capability. |
| Samsung | Option 1 is preferred. The two comments above from Intel are reasonable to us, and we support that.We see the necessity of this feature x-2, and prefer to have the mandatory capability. As usual practice, mandatory with capability signaling is recommended.  |
| Nokia | Support Option 2. |

#### Issue 1-2-3: Indication of HST FR2 RRM feature support and Applicability of enhanced RRM requirements (PC 6)

* Background

At the previous RAN4#101-bis-e the following agreements and WFs were listed:

* + Agreement:
	FR2 HST UE (power class 6 UE) shall mandatorily support both Set 1 and Set 2 enhanced RRM requirements, in terms of different RX beams (i.e., RX beam sweeping scaling factor) per UE.
	+ Way forward:
	Companies are encouraged to check further UE feature needed for the support of enhanced RRM requirements for FR2 HST:
		- **FFS, whether power class shall be used to identify the feature support**
		- FFS, whether per-band type is necessary or per-UE type is enough
	+ Way forward on the Applicability of requirements to non-PC6 UE
		- **FFS, whether enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.**
* Proposals and/or Observations:
	+ Proposal 1 (CATT): Power class shall be used to identify the feature support. From RRM perspective, Per-UE type is enough. But for RF and demod feature, it depends on conclusion from other session.
	+ Proposal 2 (Ericsson): Power class can be used to identify the feature support at least in Rel17.
	+ Proposal 3 (Apple): Enhanced requirement should be NOT applied to other than PC6 UEs even when HST FR2 flags are configured.
	+ Proposal 4 (CATT): The enhanced RRM requirements are only applicable to PC6 UEs. For other UEs, even when HST FR2 flags are configured, the enhance RRM requirements are not applicable.
	+ Proposal 5 (Ericsson): No enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.
* Candidate options:
	+ Option 1:
		- No enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.
		- PC6 shall be used to identify the feature support of HST FR2 operation.
* Recommended WF:
	+ Companies are invited to check whether Option 1 is agreeable.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Support Option1. |
| Intel | Support Option 1 |
| Huawei | Option 1 is agreeable. |
| ZTE | Support Option 1 |
| CATT | Support option 1 |
| Apple | Support |
| Samsung | Option 1.  |

### 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.*

|  |
| --- |
| **R4-2203714,** TP to TR 38.854 on the Number of Rx beams**,** by Qualcomm |
| **Company** | **Comments** |
| Ericsson | Depends on agreements of Issue 1-1-3 |
| Nokia | Text needs to be modified according to the outcome of Issue 1-1-3.  |
|  |  |

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| --- |
| **R4-2204721,** draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM, by Ericsson |
| QC | Add “when SMTC <= 40ms” into conditions according to RAN4#100e agreement |
| Samsung | As discussed above, it should be the common understanding that “No enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.” Accordingly, the following revision is suggested to reflect that the new table is only for PC6“otherwise Tidentify\_intra\_NR shall not exceed the values defined in Table 6.2.1.2.1-1 when *[highSpeedMeasFlagFR2]* isn’t configured or UE is not capable of FR2 power class 6, and in Table 6.2.1.2.1-3 when *[highSpeedMeasFlagFR2]* is configured and UE is capable of FR2 power class 6.” |
|  |  |

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| **R4-2205896,** TP to TR 38.854 – beam coverage for FR2 HST, by Nokia, Nokia Shanghai Bell |
|  |  |
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## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
| **Sub-topic** | **Status summary**  |
| **Sub-topic #1-1: General** | **Issue 1-1-1: Lightweight network assistance signaling***GTW agreements:** Agreements
	+ Inter-RRH indication
		- Do not introduce explicit inter-RRH indication signalling for NR FR2 HST in Rel-17
		- FR2 HST Inter-RRH indication signalling enancements can be considered in Rel-18 subject to RAN plenary decision
	+ FFS whether additional assumptions for the definition one shot UL timing adjustment requirements shall be introduced (e.g. UE is configured with aperiodic L1-RSRP reporting before the TCI state switch, or UE performed fine time tracking within X ms before/after TCI state switching)

*Candidate options:*None*Recommendations for 2nd round:*NoneIssue 1-1-2: LS on network signaling to RAN2*GtW agreements:*See Issue 1-1-1*Candidate options:*None*Recommendations for 2nd round:*None**Issue 1-1-3: Applicability of enhanced Set-1 RRM requirements***Background:*The companies are discussing whether there is a need to limit/recommend deployment parameters (Dmin Hdiff (height difference between train rooftop mounted CPE and RRH)) for scenarios with 2Rx beam seep requirements (set 1).It it found to be necessary a corresponding text shall be added to the TR.One of the companies is sees a large SNR difference when UE is 0 to 200m away from RRH between Dmin = 10m and Dmin = 50m. In set 2, in Dmin = 50m case we can achieve similar performance as Dmin = 10m with set 1.Proposal from the 1st round:* Proposal 1 (QC): Capture the following description of set 1 requirements applicability in TR:
* When 2Rx beam sweep based requirement (set 1) applies to the deployment scenario with Dmin > 10m or Hdiff (height difference between train rooftop mounted CPE and RRH) > 10m, performance degradation is expected.
* Proposal 2 (Ericsson): Only list or highlight benchmark of performance obtained when Dmin = [10] m, but don’t note performance difference or degradation when Dmin > [10] m.
* Proposal 3 (ZTE): The applicability restriction of 2 Rx beam requirements is necessary. For the detailed range of Dmin, a typical value such as no larger than 50 m can guarantee no significant performance degradation.
* Proposal 4 (Intel): RAN4 will not capture any strict deployment limitations for enhanced RRM requirements applicability.

New compromise proposal:“Set 1 requirements are developed based on the analysis with Dmin = 10m and Ds = 750m, and recommended applicable range of Dmin for Set 1 requirement is Dmin <= [50] m. For the deployment with larger Dmin, Set 2 requirements are recommended to be configured by network.”In Moderator’s opinion, the new proposal covers Proposals 1-3.*Tentative agreements:*None*Candidate options:** Option 1:Set 1 requirements are developed based on the analysis with Dmin = 10m and Ds = 750m, and recommended applicable range of Dmin for Set 1 requirement is Dmin <= [50] m. For the deployment with larger Dmin, Set 2 requirements are recommended to be configured by network.
	+ The value of the Dmin threshold:
		- Option 1.a: 50 m
		- Option 1.b: 30 m
* Option 2: RAN4 will not capture any strict deployment limitations for enhanced RRM requirements applicability.

*Recommendations for 2nd round:** Option 1 seems to be a compromise. Companies are encouraged to indicate whether wording of Option 1 is agreeable.
* Companies are encouraged to indicate the preferred value of Dmin applicability threshold for Set-1.

**1.2.1.4 Issue 1-1-4: Train travelling opposite to the serving beam***Background:*One of the companies makes the following proposal to address more challenging mobility when the train is moving in the direction opposite to the serving beam:In Rel-17, Configure a different mobility parameter, e.g., offset in HO and BM for opposite direction to abbreviate SNR drop duration. Further enhancement can be studied in next release.Most of the companies see this solution as based station implementation without specification impact.Additionally, one of the companies still have further question about the details of the proposed solution.It is also unclear how the proponents of the solution would like to capture their proposal in TR/Specification/WF, etc.In general, it is Moderator’s understanding, that there is no specification impact of the proposal. However, none of the companies have brought a detailed description of the solution.A possibility to provide more analysis of the scenario in the TR was already captured in the WF at RAN4#101-bis-e.*Tentative agreements:*None*Candidate options:*None*Recommendations for 2nd round:*None**1.2.1.4 Issue 1-1-5: Link simulation assumptions for L1 and L3 measurement accuracy***Background:*One of the companies has provided a draft of link simulation assumptions for L1 and L3 measurement accuracy for FR2 HST scenarios [R4-2205900].Some companies have provided their comments on the proposal.One of the companies mentions that in FR1 HST already concluded that high speed channel has no impact on RSRP measurement requirement. Thus, HST FR2 discussion might not be needed even in the performance part.Therefore, firstly, it is necessary to confirm whether measurement accuracy shall be studied in the performance part.Secondly, the simulation parameters need to be modified according to the comments.*Tentative agreements:*None*Candidate options:** Option 1: Interested companies are invited to bring link-level simulation study of L1 and L3 measurement accuracy in HST FR2
* Option 2: No L1 and L3 measurement accuracy link-level simulations are needed in HST FR2

*Recommendations for 2nd round:** Companies are invited to share their view on a need of link-level simulations of L1 and L3 measurement accuracy is needed in HST FR2
* The proposing company is encouraged to provide the updated version of the parameters for further check by other companies. Then, the parameters could be added in the WF for information.
 |
| **Sub-topic #1-2: UE capabilities and features** | **Issue 1-2-1: Type definition for HST FR2 RRM features***GtW agreement:** Agreement:
	+ The following UE feature list description for feature “x-1 Support of FR2 HST operation” is endorsed in the RRM session. Further confirmation in the RAN4 Main and Demod session is required.

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| Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | Consequence if the feature is not ignalin by the UE | Type | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| x-1 | Support of FR2 HST operation | 1) Support of FR2 UE PC62) Support of enhanced RRM requirements for FR2 HST (except the requirement for one shot large UL timing adjustment)3) Support of demodulation processing for FR2 HST  | [R15 RAN4 feature group:Support of FR2 UE power class 6] | Yes | No | UE does not meet FR2 high speed train scenario | Per Band | No | Applicable to FR2 only | N/A | FR2 UE power class PC6 signalling is used to indicate support of feature group | Optional with capability signaling |

*Tentative agreements:*The yellow-highlighted “[R15 RAN4 feature group: Support of FR2 UE power class 6]” in prerequisite feature group should be removed *Candidate options:*None*Recommendations for 2nd round:*Confirm in the 2nd round that the pre-requisite feature group can be removed.**Issue 1-2-2: Capability for one shot large UL timing adjustment***Background:*The companies seems to agree that a new feature group “Support of one shot large UL timing adjustment” is needed.However, there are different opinions whether the feature shall be defined as mandatory or optional.*Tentative agreements:*Introduce feature group x-2 “Support of one shot large UL timing adjustment” with prerequisite feature group (x-1, “Support of FR2 HST operation”)*Candidate options:** Option 1 (Intel, CATT, Samsung): Define One shot large UL timing adjustment feature as mandatory with capability signaling.
* Option 2 (QC, Apple, Nokia): Define One shot large UL timing adjustment feature as mandatory with capability signaling.
* Proposal 1 (Apple): For inter-RRH TCI state switching, whether UE can start PDCCH/PDSCH receiving without additional SSB receiving can be an UE capability.

*Recommendations for 2nd round:*Companies are encouraged to discuss in between Option 1 and Option 2 and share their view on Proposal 1 (see also Issue 2-3-1).**Issue 1-2-3: Indication of HST FR2 RRM feature support and Applicability of enhanced RRM requirements (PC 6)***Background:*This Issues addresses the following FFS:* FFS, whether power class shall be used to identify the feature support
* FS, whether enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.

*Tentative agreements:** No enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.
* PC6 shall be used to identify the feature support of HST FR2 operation.

*Candidate options:*None*Recommendations for 2nd*Agree on tentative agreeemnts. |

### 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”* |
| **R4-2203714** | **TP to TR 38.854 on the Number of Rx beams, by Qualcomm**The TR is recommended to be revised to take into account potential revision/agreement from Issue 1-1-3. |
| **R4-2204721** | **draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM, by Ericsson**The draftTR is recommended to be revised to account for the received 1st round comment. |
| **R4-2205896** | **TP to TR 38.854 – beam coverage for FR2 HST, by Nokia, Nokia Shanghai Bell**No comments were received in the fort round. Hence, the TP is recommended to be agreed. |

## Discussion on 2nd round

### Sub-topic 1-2: General

#### Issue 1-1-1: Lightweight network assistance signaling

|  |
| --- |
| **GtW Agreement:*** Agreements
	+ Inter-RRH indication
		- Do not introduce explicit inter-RRH indication signalling for NR FR2 HST in Rel-17
		- FR2 HST Inter-RRH indication signalling enancements can be considered in Rel-18 subject to RAN plenary decision
	+ FFS whether additional assumptions for the definition one shot UL timing adjustment requirements shall be introduced (e.g. UE is configured with aperiodic L1-RSRP reporting before the TCI state switch, or UE performed fine time tracking within X ms before/after TCI state switching)
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#### Issue 1-1-3: Applicability of enhanced Set-1 RRM requirements

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| **Candidate options:*** Option 1:Set 1 requirements are developed based on the analysis with Dmin = 10m and Ds = 750m, and recommended applicable range of Dmin for Set 1 requirement is Dmin <= [40] m. For the deployment with larger Dmin, Set 2 requirements are recommended to be configured by network.
	+ The value of the Dmin threshold:
		- Option 1.a: 50 m
		- Option 1.b: 30 m
* Option 2: RAN4 will not capture any strict deployment limitations for enhanced RRM requirements applicability.
 |

|  |
| --- |
| *Background:*The companies are discussing whether there is a need to limit/recommend deployment parameters (Dmin, Hdiff (height difference between train rooftop mounted CPE and RRH)) for scenarios with 2Rx beam seep requirements (set 1).If it found to be necessary, a corresponding text shall be added to the TR.*Recommendations for 2nd round:** Option 1 seems to be a compromise. Companies are encouraged to indicate whether wording of Option 1 is agreeable.
* Companies are encouraged to indicate the preferred value of Dmin applicability threshold for Set-1.
 |
| **Company** | **Comments** |
| Ericsson | We supported Option 2, but Option 1 can be acceptable. Regarding exact number of Dmin, we slight prefer Option1.a, because we consider the performance can be acceptable for set1 but not based on the degradation from set2, even we agree degradation comparison between set1 and set2 is a good metric. Generally, set1 has worse performance than set 2 in most ranges, but a too stringent Dmin may result into rare set1 implementation in practice, even set1 can have better mobility performance.  |
| QC | We support option 1, and option 1b for the threshold. When companies select between option 1a and 1b, we hope the following comments we made during the first round can be considered or discussed:1. Throughput difference:

When Dmin = 50m, the throughput difference is 20%; Dmin = 40m, the throughput difference is 15%,;and Dmin = 30m, the throughput difference is 9%, between set 1 and set 2 requirements. Given the analysis result, we consider 30m as good threshold as the tput difference is within 10%. 1. We should consider throughput instead of link budget when discussing this threshold. In practice, throughput improvement is definitely preferred, and the LOS path may not be as strong as RMaLOS model we consider in this WI.

To Ericsson: this is just the guidance instead of requirement, and the main consideration is throughput. Could you consider to compromise to 1b if we add wording like from throughput perspective? Because we already have clear mobility requirement captured in the spec and operators can check, but throughput difference is not there. Therefore, using TR to add the throughput perspective information should be beneficial to operators. |
| ZTE | We support Option 1. Between 1.a and 1.b, we are fine for both of them. |
| Samsung | Option 2 means no impact on “requirement”, so no change will be introduced to TS38.133. For Option 1, our understanding is the intention is to provide information and recommendation for NW configuration in different deployment scenarios. For option 1a and 1b, we have not yet conducted simulation and analysis yet. If the conclusion is intended to be made on this meeting, we are okay with both options. |
| Moderator | Regarding the Dmin threshold, since one company have a stronger view and others looks more flexible in their opinions, option [30] can be considered as baseline.It is recommended to share the revision of TR draft and confirm the text over the reflector.The discussion will be included into the second round summary |

## Sub-topic 1-2: UE capabilities and features

#### Issue 1-2-1: Type definition for HST FR2 RRM features

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **GtW Agreement:*** Agreement:
	+ The following UE feature list description for feature “x-1 Support of FR2 HST operation” is endorsed in the RRM session. Further confirmation in the RAN4 Main and Demod session is required.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | Consequence if the feature is not ignalin by the UE | Type | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| x-1 | Support of FR2 HST operation | 1) Support of FR2 UE PC62) Support of enhanced RRM requirements for FR2 HST (except the requirement for one shot large UL timing adjustment)3) Support of demodulation processing for FR2 HST  | [R15 RAN4 feature group:Support of FR2 UE power class 6] | Yes | No | UE does not meet FR2 high speed train scenario | Per Band | No | Applicable to FR2 only | N/A | FR2 UE power class PC6 signalling is used to indicate support of feature group | Optional with capability signaling |

**Agreement:**Remove pre-requisite feature groups “[R15 RAN4 feature group: Support of FR2 UE power class 6]” |

|  |
| --- |
| *Recommendations for 2nd round:*Confirm in the 2nd round that the pre-requisite feature group can be removed. |
| **Company** | **Comments** |
| Ericsson | Ok with recommendation. |
| Apple | Agree |
| ZTE | Fine with the recommendation. |
| Samsung | Agree, and pls. note that the main session already have GTW agreement on this (last Friday).  |

#### Issue 1-2-2: Capability for one shot large UL timing adjustment

|  |
| --- |
| **Agreement:*** Introduce feature group x-2 “Support of one shot large UL timing adjustment” with prerequisite feature group (x-1, “Support of FR2 HST operation”)

**Way forward:**Companies are encouraged to discuss further the following two options:* Option 1: Define feature as mandatory with capability signaling.
* Option 2: Define feature as optional with capability signaling.
 |

|  |
| --- |
| *Background:*The companies seems to agree that a new feature group “Support of one shot large UL timing adjustment” is needed.However, there are different opinions whether the feature shall be defined as mandatory or optional.An additional proposal to add an new UE capability in this feature group was received in the 1st round (Proposal 1).*Recommendations for 2nd round:*Companies are encouraged to discuss in between Option 1 and Option 2 and share their view on Proposal 1 (see also Issue 2-3-1). |
| **Company** | **Comments** |
| Ericsson | Support Option1. If it is optional, we doubt UE will realize the capability. And regarding fall-back solution, we understand it depends on network to enable and disable dedicated signaling, but UE shall have capacity to do one shot UL timing adjustment. Otherwise, RA and one-shot UL timing adjustment shall be optional solutions, no relevant to fall-back.  |
| Nokia | Support Option 2 as other solutions are feasible. |
| Apple | Option 2  |
| QC | We support option 2.Our question to option 1 wasn’t addressed in the first round, and paste it here:Since network as RA mechanism as an option, why we should make this feature mandatory? The system still can operate without support of this feature, RA can be a replacement. For network, RA is supported already, but for UE, one shot large UL capability is new.To us, proposal 1 is a separate capability and can be discussed separately. The capability we discussed here is the capability for the UE autonomous one shot UL timing adjustment exceed Tq. |
| Samsung | Option 1, we see the benefits from introducing one shot timing adjustment, which minimize the impact due to legacy UL timing adjustment with RA. From our understanding, this capability is independent from Issue 2-3-1. Here we are discussing only the method to adjust UL with a one shot way.  |

#### Issue 1-2-3: Indication of HST FR2 RRM feature support and Applicability of enhanced RRM requirements (PC 6)

|  |
| --- |
| **Agreement:*** No enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.
* PC6 shall be used to identify the feature support of HST FR2 operation.
 |

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2206848 | **WF on FR2 HST RRM (part 1)***Recommended to be agreed.* |
| R4-2206850 | **Revision of R4-2204721, draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM, by Ericsson***Recommended to be agreed.*Hello Anthony,Thanks for comments, we accept it. Best RegardsMing Li**From:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com> **Sent:** den 1 mars 2022 14:12**To:** Ming Li L <ming.l.li@ericsson.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR On RRC\_CONNECTED state mobility for HST FR2 RRMDear Ming,Thanks for your draft CR.Minor comments are uploaded to [Revision update of R4-2204721 draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM\_V1\_Nok.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/Revision%20update%20of%20R4-2204721%20draft%20CR%20On%20RRC_CONNECTED%20state%20mobility%20for%20HST%20FR2%20RRM_V1_Nok.docx)Best Regards,AnthonyNokia**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Ming Li L**Sent:** Friday, February 25, 2022 4:17 PM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR On RRC\_CONNECTED state mobility for HST FR2 RRMDear all,Please be informed the draft revision of the below draft CR is uploaded to: [Revision update of R4-2204721 draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM\_V1.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/Revision%20update%20of%20R4-2204721%20draft%20CR%20On%20RRC_CONNECTED%20state%20mobility%20for%20HST%20FR2%20RRM_V1.docx)

|  |  |
| --- | --- |
| R4-2204721 | draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM, by EricssonThe draftCR is recommended to be revised to account for the received 1st round comment. |

The changes in relation to the original version are:

|  |  |
| --- | --- |
| QC | Add “when SMTC <= 40ms” into conditions according to RAN4#100e agreement |
| Samsung | As discussed above, it should be the common understanding that “No enhanced requirement should be applied to other than PC6 UEs even when HST FR2 flags are configured.” Accordingly, the following revision is suggested to reflect that the new table is only for PC6“otherwise Tidentify\_intra\_NR shall not exceed the values defined in Table 6.2.1.2.1-1 when *[highSpeedMeasFlagFR2]* isn’t configured or UE is not capable of FR2 power class 6, and in Table 6.2.1.2.1-3 when *[highSpeedMeasFlagFR2]* is configured and UE is capable of FR2 power class 6.” |

Please let me known your comment if any.  |
| R4-2206849 | **Revision of R4-2203714, TP to TR 38.854 on the Number of Rx beams, by Qualcomm***Recommended to be agreed.***From:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com> **Sent:** Wednesday, March 2, 2022 8:05**To:** Petrov, Dmitry (Nokia - FI/Espoo) <dmitry.a.petrov@nokia-bell-labs.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1Hi Dmitry,We uploaded a draft of our TP to TR according to the recommended WF:[https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR\_HST\_FR2\_RRM\_1/CRs/rev\_R4-2203714\_FR2\_HST\_TP\_TR\_Rx\_Beams\_102\_v1.docx](%20https%3A/www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/rev_R4-2203714_FR2_HST_TP_TR_Rx_Beams_102_v1.docx)TP pasted below:*Set 1 requirements are developed based on the analysis with Dmin = 10m and Ds = 750m, and the recommended applicable range of Dmin for Set 1 requirement is Dmin <= [30] m. For the deployment with a larger Dmin, set 2 requirements are recommended to be configured by the network.*Will Nokia integrate the TP into TR after the approval? We want to know what the procedure we should follow after sharing the draft. Thank you.Best regards,Sean |

# Topic #2: Mobility, Measurement procedure and Signaling characteristics

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2203756 | Apple | **Discussion on measurement procedure requirement for FR2 HST****Proposal 1:*** Mpss/sss\_sync\_w/o\_gaps = 6 for set 1 and 18 for set 2.
* Mmeas\_preriod\_w/o\_gaps = 6 for set 1 and 18 for set 2.

**Proposal 2:** Enhanced requirement should be NOT applied to other than PC6 Ues even when HST FR2 flags are configured. |
| R4-2203902 | CATT | **Discussion on measurement procedure requirements for FR2 HST****Proposal 1:** Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2. When 80ms< DRX cycle≤ 320ms, 600ms or 400ms lower bounds are useless. The lower bounds of 600ms and 400ms can be removed from the formula when 80ms< DRX cycle≤ 320ms.**Proposal 2:** The enhanced RRM requirements are only applicable to PC6 Ues. For other Ues, even when HST FR2 flags are configured, the enhance RRM requirements are not applicable. |
| R4-2204254 | CMCC | **Discussion on mobility requirements for FR2 HST****Observation 1:**according to existing intra-frequency measurement requirements for non-HST scenario, the number of samples is 5 for power class 1 or 5 (fixed wireless access UE) and 3 for power class 2, 3 or 4 (moving UE). **Observation 2:** For FR2 HST, considering it is for the high speed train, it is reasonable to take the samples of moving UE type as baseline (i.e. 3 samples for power class 2, 3, 4). **Proposal 1:** scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) are proposed to be 6 for Set 1 and 18 for Set 2.    |
| R4-2204489 | ZTE Corporation | **Draft CR for Cell re-selection for HST FR2** |
| R4-2204490 | ZTE Corporation | **Draft CR for L1-RSRP measurements for Reporting for HST FR2** |
| R4-2204629 | Nokia, Nokia Shanghai Bell | **CR to TS 38.133: intra-frequency measurements without gaps for for FR2 NR HST** |
| R4-2204716 | Ericsson | **RRC Idle/Inactive and connected state mobility requirements****Proposal 1**: No need to consider more types of enhancement, besides of [highSpeedMeasFlag-FR2]. |
| R4-2204717 | Ericsson | **Measurement procedure requirements for HST FR2****Proposal 1:** support Option1. Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2.**Proposal 2:** No enhanced requirement should be applied to other than PC6 Ues even when HST FR2 flags are configured. |
| R4-2204892 | Huawei, Hisilicon | **Discussion on RRC Idle/Inactive and connected state mobility requirements for HST in FR2****Proposal 1:** The below requirements for Cell reselection in IDLE/INACTIVE mode shall apply to power class 6 UE when highSpeedMeasFlag-r17 is configured.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | **Tdetect,NR\_Intra [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra****[s] (number of DRX cycles)** |
|  |  |  |  |  |
| 0.32  | 2 or 6Note1  | 2.56 x M2 (8 x M2)  | 0.32 x M3 (1 x M3)  | 0.96 x M4 (3 x M4)  |
| 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: N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2 Note 2: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 Note 3: [When *highSpeedMeasFlag-r17* is configured, the requirements shall apply to power class 6 UE*].*  |

 |
| R4-2204894 | Huawei, Hisilicon | **Discussion on RRM requirements for high speed train scenario in FR2****Proposal 1:** In connected mode, Mpss/sss is at least 10 and 24 for set 1 and set 2 respectively. **Proposal 2:** 600ms lower bound is kept unchanged when 80ms< DRX cycle≤ 320ms.  |
| R4-2204895 | Huawei, Hisilicon | **Scheduling restriction for L1-SINR for FR2 HST** |
| R4-2205898 | Nokia, Nokia Shanghai Bell | **On remaining RRM measurement open issues for FR2 HST****Observation 1**: In Option 2, the scaling factor (Mpss/sss\_synch\_w/o\_gaps = Mmeas\_period\_w/o\_gaps = 24) for Set 2 is equal to non-HST scenarios for UE supporting power classes 3 and 4. **Observation 2**: For Set 2 in Option 2, the PSS/SSS detection and measurement time is not faster than the non-HST case for UE supporting power classes 3 and 4, which corresponds to no enhancements and not suitable for HST. **Proposal 1**: In connected mode, the scaling factor for PSS/SSS detection and measurements should be Option 1: Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2. [Moderator]: The Proposal below is treated in Topic#1.**Proposal 2**: For the enhanced requirements for Cell reselection in IDLE/INACTIVE mode, Note 2 in the table is not needed. |
| R4-2205960 | Nokia, Nokia Shanghai Bell | **TP to TR 38.854 on Legacy RRM Requirement Mobility Performance in HST FR2 Deployment Scenarios** |
| R4-2205961 | Nokia, Nokia Shanghai Bell | **TP to TR 38.854 on Analysis of Mobility Performance in HST FR2 Deployment Scenarios** |
| R4-2203755 | Apple | **Discussion on signalling characteristics requirements****Proposal 1**: Reuse current TCI state switching delay requirement. It is further study whether Tok can be 0.  |
| R4-2203900 | CATT | **Discussion on TCI switching delay for FR2 HST****Proposal 1**: When TCI is switched in FR2 HST, ISI really exists. We think one symbol for scheduling restriction can resolve the ISI issue during TCI switching. |
| R4-2203901 | CATT | **Draft CR on RLM/BFD requirement for FR2 HST** |
| R4-2204718 | Ericsson | **Signalling characteristics requirements for HST FR2****Proposal 1**: Performance degradation is expected upon inter-symbol interference during TCI switching for FR2 HST scenario. No necessity to limit receiving in RRM requirements. |
| R4-2204893 | Huawei, Hisilicon | **Discussion on signaling characteristics requirements for high speed train scenario in FR2****Proposal 1**: The legacy known condition of TCI state can be reused for FR2 HST. **Proposal 2**: Prefer to only consider known TCI switching in FR2 HST. **Proposal 3**: Introduce one slot interruption during TCI state switching due to inter-symbol interference |
| R4-2205009 | ZTE Corporation | **Discussion on Signaling characteristics for HST FR2****Proposal 1:** The ISI issue really exists between inter-RRH TCI state switching. To address this issue, introducing one symbol length scheduling restriction right after the end of slot n+ THARQ + is enough. |
| R4-2205893 | Samsung | **Remaining Issues on signaling characteristics requirements for FR2 HST**[Moderator]: Proposal 1 ca be discussed in the 2.2.4 CR/TP comments collection.**Proposal 1**: The exemplary text proposal for FR2 HST UE SSB-based RLM evaluation period is provided as:**Proposal 2**: For CSI-RS based RLM and BFD, no standard impact is expected for Rel-17 FR2 HST UE (i.e., FR2 PC6 UE). **Observation 1**: If the target TCI state is known, and the target TCI state is in the active TCI state list for PDSCH, there is no interruption allowed during MAC-CE based TCI state switching.**Observation 2**: During TCI switching between RRHs in FR2 HST scenario, it is possible to have inter-symbol interference which cannot be accommodated by the CP length of the OFDM symbol from the target RRH. **Proposal 3**: One more slot is allowed for interruption during TCI switching for FR2 HST scenario.  |
| R4-2205894 | Samsung | **Draft CR to introduce active TCI state switching delay requirement for FR2 HST UE** |

## Open issues summary

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

### Sub-topic 2-1: RRC CONNECTED and IDLE state mobility requirements

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

#### Issue 2-1-1: Cell reselection in IDLE/INACTIVE mode

* Background

Only one issue left open after the previous RAN4#101-bis-e:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Agreement:**Defined enhanced requirements for Cell reselection in IDLE/INACTIVE mode for DRX 320 ms in HST FR2 deployments:

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]**  | **Tdetect,NR\_Intra [s] (number of DRX cycles)**  | **Tmeasure,NR\_Intra [s] (number of DRX cycles)**  | **Tevaluate,NR\_Intra** **[s] (number of DRX cycles)**  |
|  |
| 0.32  | 2.56 x N1 x M2 (8 x N1 x M2) | 0.32 x N1 x M3 (1 x N1 x M3) | 0.96 x N1 x M4 (3 x M4) |  |
| Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2Note 2: [When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraRAT-MeasurementEnhancement-r16].* |  |

N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2.**Way forward:**The companies are encouraged to check the Notes and to reformulate Note 2. |

At the meeting RAN4#100-e [R4-2120292] it was agreed that

|  |
| --- |
| **Agreements:*** Defined enhanced requirements for DRX 320 ms only.
* Requirements for longer DRX cycles are left without changes.
 |

* Proposals and/or Observations
	+ Proposal 1 (Ericsson): No need to consider more types of enhancement, besides of [highSpeedMeasFlag-FR2].
	+ Proposal 2 (Huawei): The below requirements for Cell reselection in IDLE/INACTIVE mode shall apply to power class 6 UE when highSpeedMeasFlag-r17 is configured.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | **Tdetect,NR\_Intra [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra****[s] (number of DRX cycles)** |
|  |  |  |  |  |
| 0.32  | 2 or 6Note1  | 2.56 x M2 (8 x M2)  | 0.32 x M3 (1 x M3)  | 0.96 x M4 (3 x M4)  |
| 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: N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2 Note 2: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 Note 3: [When *highSpeedMeasFlag-r17* is configured, the requirements shall apply to power class 6 UE*].*  |

* + Proposal 3 (Nokia): For the enhanced requirements for Cell reselection in IDLE/INACTIVE mode, Note 2 in the table is not needed.
* Recommended WF
	+ Check that that the first two Notes from Proposal 2 are agreeable, i.e.,
	Note 1: N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2
	Note 2: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2
	+ Companies are ncouraged to reply the following two questions:
		- Q1: Whether it is necessary to list DRX cycle above 0.32 s (i.e., without enhancements) in the table with enhanced HST FR2 requirements:
			* Option 1.1 (Huawei): Yes
			* Option 1.2: No
		- Q2: Whether Notes 3 [When highSpeedMeasFlag-r17 is configured, the requirements shall apply to power class 6 UE] is needed
			* Option 2.1 (Ericsson, Huawei): Yes
			* Other formulations of the Note 3 are not precluded.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Q1, support Option 1.1Q2, Support Option 2.1, it indicates that highSpeedMeasFlag-r17 can only be applied to power class 6 UE. |
| Intel | Q1: support Option 1.1Q2: support Option 2.1 in accordance with Issue 1-2-3 |
| Huawei | Q1: support 1.1, as we did in FR1 HST. For the DRX above 0.32s, no any enhancements are made. It means that if network configures DRX above 0.32s, UE is not required to satisfy the enhanced requirements.Q2: support option 2.1. |
| Moderator | The following GtW agreement was achieved:* Agreements
	+ Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal to 6 for Set 1 and [18] for Set 2
 |
| QC | Same view as Huawei, the table in proposal 2 is good for us. |
| ZTE | Support 6 for Set 1 and 18 for Set 2.Since for For PC 2, Mpss/sss\_sync\_w/o\_gaps =24, not 40. So we can believe 3 samples is enough for the moving terminal, so for HST CPE, 3 samples is also enough. |
| CATT | Q1: option 1.1 is fine. Same as Rel-16 HSTQ2: support option 2.1.The agreements in GTW of Mpss/sss\_synch\_w/o\_gaps and are for the requirements in connected mode. This issue is idle mode. For idle mode, it has been agreed in last meeting: N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2. |
| Apple | Q1: option 1.1Q2: option 1.2 |
| Samsung | Q1: Our original understanding of existing agreement is Option 1.2 shall be followed, i.e., no requirement for DRX > 320ms. But we are okay if companies think the other rows are still necessary. Anyway, we doubt about the necessity of other rows, but we are okay if that is common understanding from other companies. Q2: The principle of Note 3 is okay, but wording needs to be improved as suggested: * Note-3: The requirement in this table shall only apply to power class 6 UE*,* when the network signaling [*highSpeedMeasFlag-r17]* is configured to [set1] or [set2],
 |
| Nokia | We would like to clarify that Note 2 in Nokia’s Proposal 3 refers to Note 2 in the table in the agreement, that is

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]**  | **Tdetect,NR\_Intra [s] (number of DRX cycles)**  | **Tmeasure,NR\_Intra [s] (number of DRX cycles)**  | **Tevaluate,NR\_Intra** **[s] (number of DRX cycles)**  |
|  |
| 0.32  | 2.56 x N1 x M2 (8 x N1 x M2) | 0.32 x N1 x M3 (1 x N1 x M3) | 0.96 x N1 x M4 (3 x M4) |  |
| Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2Note 2: [When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraRAT-MeasurementEnhancement-r16].* |  |

Note 2 should be removed, if not, updated.Q1: support Option 1.1Q2: Other formulations of the Note 3 are not precluded. The suggestion by Samsung is fine.  |

### Sub-topic 2-2: Measurement procedure requirements

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

#### Issue 2-2-1: Time period for PSS/SSS detection and Measurement period for intra-frequency measurements

* Background

At the previous RAN4#101-bis-e meeting WF [R4-2202594]:

**Agreement:**

PSS/SSS detection

Set 1:

Table 1: Time period for PSS/SSS detection when [flag1] is configured, (Frequency range FR2)

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_intra** |
| No DRX  | max(600ms, ceil([6] x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra  |
| DRX cycle≤ 80 ms | max(600ms, ceil([6] x M2Note 2 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra  |
| 80ms< DRX cycle≤ 320ms  | max(600ms, ceil(M2 x Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra  |
| DRX cycle>320ms  | ceil(Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra  |
| 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 identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

Set 2:

Table 2: Time period for PSS/SSS detection when [flag2] is configured, (Frequency range FR2)

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_intra** |
| No DRX  | max(600ms, ceil([18] x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra  |
| DRX cycle≤ 80ms | max(600ms, ceil([18] x M2Note 2 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra  |
| 80ms< DRX cycle≤ 320ms  | max(600ms, ceil(M2 x Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra  |
| DRX cycle>320ms  | ceil(Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra  |
| 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 identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

SSB measurement period

Set 1:

Table 3: Measurement period for intra-frequency measurements without gaps when [flag1] is configured (FR2)

|  |  |
| --- | --- |
| **DRX cycle** | **T SSB\_measurement\_period\_intra** |
| No DRX  | max(400ms, ceil([6] x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra  |
| DRX cycle≤ 80ms | max(400ms, ceil([6] x M2Note 2 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra  |
| 80ms< DRX cycle≤ 320ms  | max(400ms, ceil(M2x Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra   |
| DRX cycle>320ms  | ceil(Mmeas\_period\_w/o\_gaps xKp x Klayer1\_measurement ) x DRX cycle x CSSFintra  |
| 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 identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

Set 2:

Table 4: Measurement period for intra-frequency measurements without gaps when [flag2] is configured (FR2)

|  |  |
| --- | --- |
| **DRX cycle** | **T SSB\_measurement\_period\_intra** |
| No DRX  | max(400ms, ceil([18] x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra  |
| DRX cycle≤ [80ms]  | max(400ms, ceil([18] x M2Note 2 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra  |
| 80ms< DRX cycle≤ 320ms  | max(400ms, ceil(M2x Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra   |
| DRX cycle>320ms  | ceil(Mmeas\_period\_w/o\_gaps xKp x Klayer1\_measurement ) x DRX cycle x CSSFintra  |
| 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 identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

**Way forward:**

* Discuss the following options to define the scaling factors:
	+ Option 1: Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2
	+ Option 2: Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 10 for Set 1 and 24 for Set 2
* Companies are encouraged to check, whether 600ms lower bound is makes sense when 80ms< DRX cycle≤ 320ms
* Proposals and/or Observations
	+ Proposal 1 (Apple):
		- Mpss/sss\_sync\_w/o\_gaps = 6 for set 1 and 18 for set 2.
		- Mmeas\_preriod\_w/o\_gaps = 6 for set 1 and 18 for set 2.
	+ Proposal 2 (CATT): Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2. When 80ms< DRX cycle≤ 320ms, 600ms or 400ms lower bounds are useless. The lower bounds of 600ms and 400ms can be removed from the formula when 80ms< DRX cycle≤ 320ms.
	+ Observation 1 (CMCC): according to existing intra-frequency measurement requirements for non-HST scenario, the number of samples is 5 for power class 1 or 5 (fixed wireless access UE) and 3 for power class 2, 3 or 4 (moving UE).
	+ Observation 2 (CMCC): For FR2 HST, considering it is for the high speed train, it is reasonable to take the samples of moving UE type as baseline (i.e. 3 samples for power class 2, 3, 4).
	+ Proposal 3 (CMCC): scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) are proposed to be 6 for Set 1 and 18 for Set 2.
	+ Proposal 4 (Ericsson): support Option1. Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2.
	+ Proposal 5 (Huawei): In connected mode, Mpss/sss is at least 10 and 24 for set 1 and set 2 respectively.
	+ Observation 3 (Nokia): In Option 2, the scaling factor (Mpss/sss\_synch\_w/o\_gaps = Mmeas\_period\_w/o\_gaps = 24) for Set 2 is equal to non-HST scenarios for UE supporting power classes 3 and 4.
	+ Observation 4 (Nokia): For Set 2 in Option 2, the PSS/SSS detection and measurement time is not faster than the non-HST case for UE supporting power classes 3 and 4, which corresponds to no enhancements and not suitable for HST.
	+ Proposal 6 (Nokia): In connected mode, the scaling factor for PSS/SSS detection and measurements should be Option 1: Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2.
	+ Observation 5 (Qualcomm): The additional pathloss for option 2 (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps =24) is within 5dB and SINR is kept above 10dB during the cell identification time, which is more than sufficient to maintain connection.
	+ Proposal 7 (Nokia): For FR2 HST neighboring cell search enhancement, set scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 10 for Set 1 and 24 for Set 2.
* Candidate options:
	+ Option 1 (Apple, CATT, CMCC, Ericsson, Nokia): Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2
	+ Option 2 (Huawei, Qualcomm): Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 10 for Set 1 and 24 for Set 2
* Recommended WF
	+ Discuss the candidate options in the 1st round, identifying a possible compromise.
	+ A candidate for the GtW.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Support Option1, 3 samples \*RX beam number shall be applicable.  |
| Intel | Support Option 1. In our understanding Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps extension to 40 for PC1 and PC5 can be explained by the fact that PC1 and PC5 UE are Fixed wireless access Ues for which the following is applicable:* They can have more than 8 Rx beams
* They don’t have mobility issues, so they can collect more samples to increase SNR

Both abovementioned point are not applicable for FR2 HST CPE, so PC2/3/4 assumption of 3\*NRX\_beam can be used |
| Huawei | In legacy, 3 samples are needed for PC 2, 3, 4 assuming RX beam is 8. In FR2 HST, especially for scenario B, considering in practical deployment the UE Rx sweeping range is large (e.g., RRH are installed in two sides of railway). Based on the agreed 6 RX beams, the beam gain may be decreased compared with legacy 8 Rx beams. With reduced RX beam gain, 3 samples may not be sufficient for measurement. Therefore we can compromise that Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps is 6 for set 1, but we still have concern on 18 for set 2. |
| Moderator | The following GtW agreement was achieved:* Agreements
	+ Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal to 6 for Set 1 and [18] for Set 2

It recommended to discontinue the discussion of the issue. |

#### Issue 2-2-2: Lower bound for 80ms< DRX cycle≤ 320ms

* Background

At the previous meeting companies were encouraged to check, whether 600ms lower bound makes sense when 80ms< DRX cycle≤ 320ms. See the previous issue for the Tables.

* Proposals and/or Observations
	+ Proposal 1 (CATT): Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2. When 80ms< DRX cycle≤ 320ms, 600ms or 400ms lower bounds are useless. The lower bounds of 600ms and 400ms can be removed from the formula when 80ms< DRX cycle≤ 320ms.
	+ Proposal 2 (Huawei): 600ms lower bound is kept unchanged when 80ms< DRX cycle≤ 320ms.
* Candidate options:
	+ Option 1 (CATT): The lower bounds of 600ms and 400ms can be removed from the formula when 80ms< DRX cycle≤ 320ms.
	+ Option 2 (Huawei): 600 ms lower bound is kept unchanged when 80ms< DRX cycle≤ 320ms
	+ Other Options are not precluded
* Recommended WF
	+ Companies are encouraged to discuss the candidate options.
	+ Please, clarify in Option 1, whether the whole row in tables shall be removed, i.e., the last row shall be updated to use DRX cycle>80ms.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | Depending on the conclusion of issue 2-2-1 |
| Moderator | Following the GtW discussion, it is recommended to follow the previous, i.e., keep the agreed format of the tables, introduce enhancements only for DRX cycle≤ 80ms, and keep non-enhanced requirements for DRX cycle 80ms< DRX cycle≤ 320ms and DRX cycle>320ms without any modification. |
| QC | Support moderator recommendation. |
| CATT | We don’t propose to remove the whole row. The only modification is highlighted. It is redundant to keep the comparison because ceil(M2 x Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle) must be larger than 600ms and 400ms.

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_intra** |
| No DRX  | max(600ms, ceil([6] x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra  |
| DRX cycle≤ 80 ms | max(600ms, ceil([6] x M2Note 2 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra  |
| 80ms< DRX cycle≤ 320ms  | ~~max(600ms,~~ ceil(M2 x Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra  |
| DRX cycle>320ms  | ceil(Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra  |
| 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 identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

|  |  |
| --- | --- |
| **DRX cycle** | **T SSB\_measurement\_period\_intra** |
| No DRX  | max(400ms, ceil([6] x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra  |
| DRX cycle≤ 80ms | max(400ms, ceil([6] x M2Note 2 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra  |
| 80ms< DRX cycle≤ 320ms  | ~~max(400ms,~~ ceil(M2x Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra   |
| DRX cycle>320ms  | ceil(Mmeas\_period\_w/o\_gaps xKp x Klayer1\_measurement ) x DRX cycle x CSSFintra  |
| 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 identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

 |
| Apple | Support modulator's suggestion.  |
| Samsung | Moderator’s recommendation is okay.  |

### Sub-topic 2-3: Signaling characteristics

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

#### Issue 2-3-1: TCI switching delay

* Background

Agreement from RAN4#101-e:

The existing 1280ms duration for known condition is applied for FR2 HST scenario

Current requirements are defined in Clause 8.10 of TS 38.133:

TOk = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

* Proposals and/or Observations
	+ Proposal 1 (Apple): Reuse current TCI state switching delay requirement. It is further study whether TOk can be 0.
	+ Proposal 2 (Huawei): The legacy known condition of TCI state can be reused for FR2 HST.
	+ Proposal 3 (Huawei): Prefer to only consider known TCI switching in FR2 HST.
* Candidate options:
	+ Option 1 (Apple): ~~TO~~~~k~~ ~~can be 0~~ For inter-RRH TCI state switching, TOk is 1. For intra-RRH TCI state switching, TOk can be 0.
	+ Option 2 (Apple, Huawei): The legacy known condition of TCI state can be reused for FR2 HST
* Recommended WF
	+ It is recommended to use the former agreement from RAN4#101-e and discontinue further discussion.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | To our understanding, keeping current requirements isn’t controversial with Option1 and Option2. |
| Intel | Agree with Recommended WF |
| Huawei | Fine with the recommended WF. |
| ZTE | Fine with the recommended WF. |
| CATT | Fine with the recommended WF.  |
| Apple | @Modulator, sorry for the late edits on our position. Missed it last week. Can be discussed together with issue 2-3-2. Our proposal is that for inter-RRH TCI state switching, due to large timing difference, UE will need to perform SSB detection after receiving TCI state switching. Therefore, TOk should be 1. Basically gNB should not configure the TCI state in the active TCI state list. For intra-RRH TCI state switching, TOk can be 0.   |
| Samsung | Agree with moderators’ recommended WF. TOk is for whether or not target TCI state is in the active TCI list, and it is not relevant to the one slot/symbol scheduling restriction due to large DL delay difference.  |

#### Issue 2-3-2: Inter-symbol interference during TCI switching

* Background

WF from RAN4#101-bis-e:

FFS how to avoid inter-symbol interference during TCI switching for FR2 HST scenario.

* Proposals and/or Observations
	+ Proposal 1 (CATT): When TCI is switched in FR2 HST, ISI really exists. We think one symbol for scheduling restriction can resolve the ISI issue during TCI switching.
	+ Proposal 2 (Ericsson): Performance degradation is expected upon inter-symbol interference during TCI switching for FR2 HST scenario. No necessity to limit receiving in RRM requirements.
	+ Proposal 3 (Huawei): Introduce one slot interruption during TCI state switching due to inter-symbol interference
	+ Proposal 4 (ZTE): The ISI issue really exists between inter-RRH TCI state switching. To address this issue, introducing one symbol length scheduling restriction right after the end of slot n+ THARQ + is enough.
	+ Observation 1 (Samsung): If the target TCI state is known, and the target TCI state is in the active TCI state list for PDSCH, there is no interruption allowed during MAC-CE based TCI state switching.
	+ Observation 2 (Samsung):: During TCI switching between RRHs in FR2 HST scenario, it is possible to have inter-symbol interference which cannot be accommodated by the CP length of the OFDM symbol from the target RRH.
	+ Proposal 5 (Samsung): One more slot is allowed for interruption during TCI switching for FR2 HST scenario.
* Candidate options:
	+ Option 1 (CATT, Huawei, ZTE, Samsung): One more slot is allowed for interruption during TCI switching for FR2 HST scenario, i.e., right after the end of slot n+ THARQ + .
	+ Option 2(Ericsson): No necessity to limit receiving in RRM requirements.
* Recommended WF
	+ Discus candidate options in the 1st round.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | When inter-RRH TCI state transition, ISI does not always occur. The realistic performance degradation depends on practical Ds, and even in the worst-case scenario, the ISI duration is less than 1 symbol. Meanwhile, it’s unclear how PDCCH receiving will be affected. We don’t prefer one slot interruption for a nonconstant interference. |
| Intel | The propagation delay difference is smaller than symbol length, so there is no need to waste the whole slot while only one symbol is affected. We may just restrict one symbol by extending the TCI state switching delay. An example of spec change is as follows:*If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at* ***symbol #m of*** *the first slot that is after slot n+ THARQ + + TOk\*(Tfirst-SSB + TSSB-proc) / NR slot length****, where m = 1 for power class 6 and m = 0 for other power classes****. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ + .Where THARQ is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];*  |
| Huawei | Prefer option 1. The one trip delay difference is larger than CP length may happen at the inter-RRH scenario. |
| QC | We suggest to combine the discussion to scheduling restriction, since scheduling restriction is larger than 1 slot. |
| ZTE | Support Option 1. But for other procedure such as proposed by QC in timing issue, the scheduling restriction should be further check.  |
| CATT | We agree the ISI occurs. But one symbol is enough. |
| Apple | Similiar to our comments in issue 2-3-1. The inter symbol interference issue only happen when TCI state is known and in the active TCI state list. However, we do not think it is reasonable to assume UE can track time/freq of two TCI state from inter-RRH simultaneously due to the large propagation delay. Our proposal is inter-RRH TCI state switching should not be in active TCI list, TOk = 1. There is no inter-symbol interference in this case. If some UE is capable to maintain time/freq sync for inter-RRH switching, TOk =0, then 1 symbol is enough. We propose to add UE capability to support inter-RRH active TCI state or not if needed.  |
| Samsung | During TCI state switching, RAN4 don’t introduce an dedicated section for DL scheduling restriction, but it is specified in the active TCI state switching delay requirement by using the wording “…UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot …”, which can be regarded as implicit scheduling restriction. We think similar approach can be followed, and based on that we have the proposal and corresponding dCR. For other companies’ proposed restriction on 1 symbol length rather than 1 slot, we are okay with the proposal, since it is useful for minimizing system performance impact.  |
| Apple2  | One additional point we would like to raise on scheduling restriction is on SSB. In 104bis-e, it was agreed that “RAN4 introduce scheduling restriction for the symbol before and after reference symbols used for L1-RSRP measurement. Such scheduling restriction shall be specified in clauses of L1 measurement (i.e., L1-SINR and L1-RSRP)”It is observed that SSB pattern for 120KHz and 240KHz has SSBs adjacent to each other. In 120KHz SCS, 2 SSBs are adjacent to each other, and for 240KHz SCS, 4 SSBs are adjacent to each other. In this case, the inter-symbol interference between different SSBs and the corresponding restriction should apply as well. To minimize L1-RSRP measurement impact and limit specification change, network should not use adjacent SSBs in FR2 HST. For example, in case of 120KHz SCS, network should not use SSB0 and SSB1 together. SSB0 and SSB2, or SSB1 and SSB2 are valid.   |

#### Issue 2-3-3: CSI-RS based RLM and BFD requirements

* Background
* Proposals
	+ Proposal 1 (Samsung): For CSI-RS based RLM and BFD, no standard impact is expected for Rel-17 FR2 HST UE (i.e., FR2 PC6 UE).
* Recommended WF
	+ Check in the 1st round whether Proposal 1 is agreeable.

Companies views’ collection for 1st round:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | Fine with proposal 1. |
| QC | Agree with proposal 1. |
| CATT | Fine with P1.  |
| Samsung | As proponent of P1, we support this proposal.  |
| Nokia | Support Proposal 1.  |

### 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.*

|  |
| --- |
| **R4-2204489**, Draft CR for Cell re-selection for HST FR2, by ZTE Corporation |
| **Company** | **Comments** |
| QC | 1. The cell re-selection requirement is for neighboring cell, not serving cell. Even in FR1 HST with 500km/h, we don't have serving cell measurement enhancement in idle mode2. The agreed enhancement is on DRx = 320ms only, the rest should follow legacy instead of FR1 HST scaling factors3. We need to change ""not......or"" to ""neither....nor"" |
| CATT | According to Issue 2-1-1, the enhancement is only for DRX 0.32s. |
| Samsung | Similar to QC, the improvement for Idle mode’s serving cell measurement is not necessary. So changes to Section 4.2.2.2 is not necessary. For intra-frequency measurement, the table can be further refined based on the conclusion from Issue 2-1-1. Furthermore, it is suggested to add “FR2 PC6” to restrict the applicable UE PC in the following revision: “For FR2 power class 6 UE configured with *[highSpeedMeasFlagFR2-r17]*, Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate, NR\_intra are specified in Table 4.2.2.3-3.” |

|  |
| --- |
| **R4-2204490**, Draft CR for L1-RSRP measurements for Reporting for HST FR2, by ZTE Corporation |
| **Company** | **Comments** |
| QC | 1. highSpeedMeasFlagFR2-r17 can not be both FR2 HST rrm flag and requirement set IE2. Why change in sharing factor is needed?3. Note 2 can be removed4. ""When SMTC <= 40ms"" should be added before ""N=2 when [highSpeedMeasFlagFR2-r17] "", and note 3 and M2 can also be removed, since M2 = 1 when SMTC is <= 40. In RAN4#100e, we agreed that FR2 HST enhancement is applicable to SMTC <= 40ms only. |
| Samsung | The relevant changes should be applicable to FR2 PC6 when highSpeedMeasFlagFR2-r17 is configured. So “FR2 PC6” is needed to be added as our comment to other CR. Also need the changes to scheduling restriction as Huawei did for L1-SINR.  |
| ZZZ |  |

|  |
| --- |
| **R4-2204629,** CR to TS 38.133: intra-frequency measurements without gaps for for FR2 NR HST, by Nokia, Nokia Shanghai Bell |
| **Company** | **Comments** |
| QC | 1. Last to rows in Table 9.2.5.1-11 should be removed since FR2 HST enhancement is applicable to DRx <= 80ms2. Where is M1 used?3. Since in RAN4#100e, we agreed that FR2 HST enhancement is applicable to SMTC <= 40ms, Note 3 should be replaced by this table is applicable to SMTC <= 40ms.4. The above 3 comments are applicable to Table 9.2.5.2-7 |
| Nokia | Thanks for the feedback. In response to QC’s questions:1. This is the same as Issue 2-2-2. It was recommended in the GTW to keep those nonenhanced requirements in the table.2. M1 is used as shown in the table below:

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, ceil(M1Note 2 x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 80ms | max(600ms, ceil(M1Note 2 x M2Note 3 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| 80ms< DRX cycle≤ 320ms | max(600ms, ceil(M2Note 3 x Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| 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: For UE supporting power class 6, M1= 6 if [*highSpeedMeasFlagFR2-r17* = set1] or M1= 18 if [*highSpeedMeasFlagFR2-r17* = set2]NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

3. The proposed modification is fine with us. |
| ZZZ |  |

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| --- |
| **R4-2204895**, Scheduling restriction for L1-SINR for FR2 HST, by Huawei, Hisilicon |
| **Company** | **Comments** |
| **Company** | **Comments** |
| Samsung | We realized that there is an typo for existing L1-SINR requirement for scheduling restriction. The red part needs to be corrected, but it should be introduced by a Rel-16 maintenance CR (as Rel-16 eMIMO rapporteur, we can prepare that in the next meeting). For others, we can introduce in this CR by emphasize the requirement is only applicable to FR2 PC6 UE. - The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI/CSI-RS for L1-RSRP measurement on the ~~CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR ~~in non-HST scenario~~ for FR2 power class 6 UE not configured with [highSpeedMeasFlagFR2-r17], and for UE not supporting FR2 power class 6;.- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI/CSI-RS for L1-RSRP measurement on the ~~CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR, and on 1 data symbol before ~~each CSI-RS for L1-RSRP measurement symbols to be measured for L1-SINR~~ and 1 data symbol after ~~each CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR for FR2 power class 6 UE configured with [highSpeedMeasFlagFR2-r17]~~in HST scenario~~. |
| Nokia | Pending the outcome of Issue 2-3-2.  |

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| --- |
| **R4-2205960**, TP to TR 38.854 on Legacy RRM Requirement Mobility Performance in HST FR2 Deployment Scenarios, by Nokia, Nokia Shanghai Bell |
| **Company** | **Comments** |
| XXX |  |
| YYY |  |
| ZZZ |  |

|  |
| --- |
| **R4-2205961**, TP to TR 38.854 on Analysis of Mobility Performance in HST FR2 Deployment Scenarios, by Nokia, Nokia Shanghai Bell |
| **Company** | **Comments** |
| QC | Should specify that it is from Nokia in clause title |
| YYY |  |
| ZZZ |  |

|  |
| --- |
| **R4-2203901**, Draft CR on RLM/BFD requirement for FR2 HST, by CATT |
| **Company** | **Comments** |
| **Ericsson** | RX beam number is 8 with respect to previous agreements.Suggest changing to ‘The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-2 for FR2 power class 6, scaling factor N=8 when [enable high speed measurement for FR2] is configured’ |
| XXX | QC: It was agreed in RAN4#101e: No enhancement on CBD requirements for DRX <=80ms, the CBD part should be removed |
| CATT | Fine to remove “Third change” of Ch8.5.5 due to the agreement:**For CBD requirements*** + No enhancement on CBD requirements for DRX <=80ms
 |
| Samsung | The relevant changes should be applicable to FR2 PC6 when highSpeedMeasFlagFR2-r17 is configured. So “FR2 PC6” is needed to be added as our comment to other CR. Accordingly, the following revision is suggested: TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-2 for FR2 with scaling factor N=8, for FR2 power classes other than power class 6 or [highSpeedMeasFlagFR2-r17] is not configured.TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-2 for FR2 power class 6 UE with [highSpeedMeasFlagFR2-r17] configured, scaling factor N=2 when ~~[enable high speed measurement for FR2] is configured and [RRM requirement for Sets] is configured and set~~ [highSpeedMeasFlagFR2-r17] is configured to [set1], scaling factor N=6 when ~~[enable high speed measurement for FR2] is configured and [RRM requirement for Sets] is configured and set~~ [highSpeedMeasFlagFR2-r17] is configured to [set2]. The requirement for power class 6 is only applicable to the configuration with no DRX or DRX cycle≤80ms. |

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| **R4-2205894,** Draft CR to introduce active TCI state switching delay requirement for FR2 HST UE, by Samsung |
| **Company** | **Comments** |
| Samsung | Depends on corresponding issue, if one symbol rather than one slot is back off, then we can change CR accordingly.  |
| YYY |  |
| ZZZ |  |

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| --- |
| **R4-2205893**, Remaining Issues on signaling characteristics requirements for FR2 HST, by Samsung* text proposal for FR2 HST UE SSB-based RLM evaluation period
* text proposal for MAC-CE based TCI state switching delay
 |
| **Company** | **Comments** |
| QC | Should be discussed in corresponding CR |
| Samsung | No need to be further discussed here, and can treat dCR and other companies’ dCR directly.  |
| ZZZ |  |

## Summary for 1st round

### Open issues

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

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| **Sub-topic** | **Status summary**  |
| **Sub-topic #2-1: RRC CONNECTED and IDLE state mobility requirements** | **Issue 2-1-1: Cell reselection in IDLE/INACTIVE mode***Background:*In the first round the companies have checked the format and notes of the requirements table for cell reselection in IDLE/INACTIVE mode.The following questions were considered:* Check that that the first two Notes from Proposal 2 are agreeable, i.e.,Note 1: N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2 Note 2: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2
* Companies are encouraged to reply the following two questions:
	+ Q1: Whether it is necessary to list DRX cycle above 0.32 s (i.e., without enhancements) in the table with enhanced HST FR2 requirements:
		- Option 1.1 (Huawei): Yes
		- Option 1.2: No
	+ Q2: Whether Notes 3 [When highSpeedMeasFlag-r17 is configured, the requirements shall apply to power class 6 UE] is needed
		- Option 2.1 (Ericsson, Huawei): Yes
		- Other formulations of the Note 3 are not precluded.

*Tentative agreements:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | **Tdetect,NR\_Intra [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra****[s] (number of DRX cycles)** |
|  |  |  |  |  |
| 0.32  | 2 or 6Note1  | 2.56 x M2 (8 x M2)  | 0.32 x M3 (1 x M3)  | 0.96 x M4 (3 x M4)  |
| 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: N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2 Note 2: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 Note-3: The requirement in this table shall only apply to power class 6 UE*,* when the network signaling [*highSpeedMeasFlag-r17]* is configured to [set1] or [set2], |

*Candidate options:*None*Recommendations for 2nd round:*Agree on the tentative agreement. |
| **Sub-topic #2-2: Measurement procedure requirements** | **Issue 2-2-1: Time period for PSS/SSS detection and Measurement period for intra-frequency measurements***Background:*Two main candidate options were discussed in the first round:* Option 1: Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 6 for Set 1 and 18 for Set 2
* Option 2: Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal 10 for Set 1 and 24 for Set 2

*GtW agreement:** Agreements
	+ Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal to 6 for Set 1 and [18] for Set 2

*Candidate options:*None*Recommendations for 2nd round:*None**Issue 2-1-2: Lower bound for 80ms< DRX cycle≤ 320ms***Background:*One of the companies has proposed to remove “max” operator in the requirements for 80ms< DRX cycle≤ 320ms. However, following GtW discussion and received comments the companies seem to prefer to keep the non-enhanced requirements without any changes.The format of the tables was already agreed in the previous meeting. Hence, the GtW agreement from the Issue 2-1-1 should be sufficient.*Tentative agreements:*None*Candidate options:*None*Recommendations for 2nd round:*None |
| **Sub-topic #2-3: Signaling characteristics** | **Issue 2-3-1: TCI switching delay***Background:*The Option 1 has been clarified by the proposing company:Our proposal is that for inter-RRH TCI state switching, due to large timing difference, UE will need to perform SSB detection after receiving TCI state switching. Therefore, TOk should be 1. Basically gNB should not configure the TCI state in the active TCI state list. For intra-RRH TCI state switching, TOk can be 0. Also from the next Issue:If some UE is capable to maintain time/freq sync for inter-RRH switching, TOk =0, then 1 symbol is enough. We propose to add UE capability to support inter-RRH active TCI state or not if needed. *Tentative agreements:*None*Candidate options:** Option 1: For inter-RRH TCI state switching, TOk is 1. For intra-RRH TCI state switching, TOk can be 0.
* Option 2: The legacy known condition of TCI state can be reused for FR2 HST

*Recommendations for 2nd round:*Since Option 1 was updated the companies are encouraged to share their view on Option 1.**Issue 2-3-2: Inter-symbol interference during TCI switching***Background:*One of the companies prefers not to introduce one slot interruption for a nonconstant interference.One more company commented that:* The inter symbol interference issue only happen when TCI state is known and in the active TCI state list.
* Inter-RRH TCI state switching should not be in active TCI list, TOk = 1. There is no inter-symbol interference in this case.
* If some UE is capable to maintain time/freq sync for inter-RRH switching, TOk =0, then 1 symbol is enough.

The same company has a new proposal on scheduling restriction on SSB:To minimize L1-RSRP measurement impact and limit specification change, network should not use adjacent SSBs in FR2 HST.Other companies seems to agree that one additional symbol delay should be enough to avoid interference.*Tentative agreements:*None*Candidate options:** Option 1 (Intel, Samsung, CATT, ZTE): *UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at* ***symbol #m of*** *the first slot that is after slot n+ THARQ + + TOk\*(Tfirst-SSB + TSSB-proc) / NR slot length****, where m = 1 for power class 6 and m = 0 for other power classes****.*
* Option 2 (Ericsson): No necessity to limit receiving in RRM requirements.
* Option 3 (Apple): Define an additional symbol of interruption during TCI switching only for the UEs capable to maintain time/freq sync for inter-RRH switching.

*Recommendations for 2nd round:** Discussion Candidate options in the second round.
* Coordinate the discussion with [102-e][213]NR\_HST\_FR2\_ RRM\_2
* Introduce new issue in the 2nd round on scheduling restriction is on SSB

**Issue 2-3-3: CSI-RS based RLM and BFD requirements***Background:**Tentative agreements:*For CSI-RS based RLM and BFD, there is no standard impact ~~is expected~~ for Rel-17 FR2 HST UE (i.e., FR2 PC6 UE).*Candidate options:*None*Recommendations for 2nd round:*Agree on tentative agreement. |

### 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”* |
| **R4-2204489** | **Draft CR for Cell re-selection for HST FR2, by ZTE Corporation**Revision is recommended to take 1st round comments into account. |
| **R4-2204490** | **Draft CR for L1-RSRP measurements for Reporting for HST FR2, by ZTE Corporation**Revision is recommended to take 1st round comments into account. |
| **R4-2204629** | **CR to TS 38.133: intra-frequency measurements without gaps for for FR2 NR HST, by Nokia, Nokia Shanghai Bell**Revision is recommended to take 1st round comments into account. |
| **R4-2204895** | **Scheduling restriction for L1-SINR for FR2 HST, by Huawei, Hisilicon**Revision is recommended to take 1st round comments into account. Also pending on the agreement in Issue 2-3-2. |
| **R4-2205960** | **TP to TR 38.854 on Legacy RRM Requirement Mobility Performance in HST FR2 Deployment Scenarios, by Nokia, Nokia Shanghai Bell**Is agreeable since no comment were received. |
| **R4-2205961** | **TP to TR 38.854 on Analysis of Mobility Performance in HST FR2 Deployment Scenarios, by Nokia, Nokia Shanghai Bell**Since the new section in the TP:6.3.4.1.3 Conclusions on mobility performanceIs the sub-section of6.3.4.1 System-level evaluation of mobility performance **from Nokia**No changes to the TP are needed.The TP is recommended to be agreed. |
| **R4-2203901** | **Draft CR on RLM/BFD requirement for FR2 HST, by CATT**Revision is recommended to take 1st round comments into account. |
| **R4-2205894** | **Draft CR to introduce active TCI state switching delay requirement for FR2 HST UE, by Samsung**Revision is recommended to take agreement from Issue 2-3-2 into account. |
| **R4-2205893** | **Remaining Issues on signaling characteristics requirements for FR2 HST, by Samsung**It is a discussion paper. Included TPs do not require a separate consideration. |

## Discussion on 2nd round

## Sub-topic 2-1: RRC CONNECTED and IDLE state mobility requirements

#### Issue 2-1-1: Cell reselection in IDLE/INACTIVE mode

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| **Agreement:**

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| **DRX cycle length [s]** | **Scaling Factor (N1)** | **Tdetect,NR\_Intra [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra****[s] (number of DRX cycles)** |
|  |  |  |  |  |
| 0.32  | 2 or 6Note1  | 2.56 x N1 x M2 (8 x N1 x M2)  | 0.32 x N1 x M3 (1x N1 x M3)  | 0.96 x N1 x M4 (3 x N1 x M4)  |
| 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: N1 refers to the number of Rx beams and equals 2 for Set 1, and 6 for Set 2 Note 2: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 Note-3: The requirement in this table shall only apply to power class 6 UE*,* when the network signaling [*highSpeedMeasFlag-r17]* is configured to [set1] or [set2], |

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| *Recommendations for 2nd round:*Agree on tentative agreement. |
| **Company** | **Comments** |
| Ericsson | Agree on tentative agreement. |
| Apple | Agree  |
| QC | Support the tentative agreement. |
| ZTE | We believe “x N1” was missing for 0.32 case, so we add it. |
| Samsung | We agree with the tentative agreement with the correction from ZTE.  |

## Sub-topic 2-2: Measurement procedure requirements

#### Issue 2-2-1: Time period for PSS/SSS detection and Measurement period for intra-frequency measurements

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| **GtW Agreement:*** Agreements
	+ Scaling factors (Mpss/sss\_synch\_w/o\_gaps and Mmeas\_period\_w/o\_gaps) equal to 6 for Set 1 and [18] for Set 2
 |

## Sub-topic 2-3: Signaling characteristics

#### Issue 2-3-1: TCI switching delay

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| **GtW agreement:**Introduce additional TCI switching delay for UE to perform fine downlink timing tracking |

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| *Background:*The Option 1 has been clarified by the proposing company:Our proposal is that for inter-RRH TCI state switching, due to large timing difference, UE will need to perform SSB detection after receiving TCI state switching. Therefore, TOk should be 1. Basically gNB should not configure the TCI state in the active TCI state list. For intra-RRH TCI state switching, TOk can be 0. Also from the next Issue:If some UE is capable to maintain time/freq sync for inter-RRH switching, TOk =0, then 1 symbol is enough. We propose to add UE capability to support inter-RRH active TCI state or not if needed. *Recommendations for 2nd round:** Since Option 1 was updated the companies are encouraged to share their view on Option 1.
* It is recommended to take into account the discussion in Issue 3-2-1 and in [213]NR\_HST\_FR2\_RRM\_2
 |
| **Company** | **Comments** |
| Ericsson | We don’t suggest to add a capability specially for inter-RRH switching, we suggest follows current rule: ‘TOk = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.’ If UE can handle/track multiple TCI state and the TCI state is in active TCI state list, only needs to follow the req. when Tok=0.  |
| Nokia | Options 1 and 2 do not conflict with each other. Option 1 is related to sub-topic 1-3 in thread [213] which is under discussion.Support Option 2. |
| Apple | If UE indicate the supported active TCI state is 2, typically it does not consider the case where 4CP timing offset is observed with TCI state switching. So it is possible UE support 2 active TCI state for intra-RRH, but only 1 active TCI state for inter-RRH due to large timing offset. We support both option 1 and option 2. If new UE capability is not introduced, by default, gNB should assume 1 active TCI state for inter-RRH switching.  |
| QC | SSB after TCI state switch is for fine timing tracking (time tracking based on CIR instead of SSB detection). If SSB detection is after TCI state switching, TOk should be 2 instead of 1. However, if our proposal in thread 213 can be agreed, SSB detection is not needed after TCI state switching, and TOk can be 1 in that case.It’s not obvious why intra-RRH TCI state switching has Tok = 0 since the target TCI state may not be in the active TCI state list. Even if it is, 1 additional slot/symbol might need to be added to account for the propagation delay difference. |
| ZTE | Support Option 2.If inter-RRH indication allowed, Option 1 makes sense. But it has been agreed not introducing any NW assistance signaling, we concern Option 1 is not realistic since before acquiring new DL timing, UE do not known whether inter-RRH switching happening or not. Option 1 is somehow causality problem.  |
| Samsung | As we comment in the email thread 213, we think the definition of TOk, i.e., the additional time allowed if the target TCI state is not in the active TCI state list. How to enlarge the time for UE to track the timing of the target TCI state can be FFS, but based on the original logic, if UE can track more than one active TCI state in the list while the target TCI state is contained in the list, TOk should still be equal to 0, since the target TCI state is tracked as active TCI state.  |

#### Issue 2-3-2: Inter-symbol interference during TCI switching

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| **Agreement:**Define an additional symbol of delay during TCI switching when TOk=0 for PC6 UEs. |

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| *Background:*One of the companies prefers not to introduce one slot interruption for a nonconstant interference.One more company commented that:* The inter symbol interference issue only happen when TCI state is known and in the active TCI state list.
* Inter-RRH TCI state switching should not be in active TCI list, TOk = 1. There is no inter-symbol interference in this case.
* If some UE is capable to maintain time/freq sync for inter-RRH switching, TOk =0, then 1 symbol is enough.

Other companies seems to agree that one additional symbol delay should be enough to avoid interference.*Recommendations for 2nd round:** Discussion Candidate options in the second round.
* Coordinate the discussion with [102-e][213]NR\_HST\_FR2\_ RRM\_2
 |
| **Company** | **Comments** |
| Ericsson | If Tok=1, no ISI; if Tok=0, ISI exists and one additional symbol delay can be defined.Update:For more clarification on the additional symbol: if Tok=0, we prefer to shorten the PDCCH symbols with old TCI state, but it’s OK with Option1, adding 1 symbol on delay with new TCI state.  |
| Nokia | For unidirectional deployment scenarios, ISI occurs when UE is moving in the same direction as RRH TX beams but not when UE is moving in the opposite direction to the RRH Tx beams. It is not clear if there is ISI in bidirectional deployment scenarios.  |
| Apple | If Tok=1, no ISI. For Tok=0, as we commented for issue 2-3-1, if UE capability for inter-RRH TCI state switching is not introduced, then network should not configure inter-RRH TCI state in active TCI list. If Tok=0, option 3 is a super set of option 1, which can be either the 1st symbol of new TCI state, or the last symbol of the old TCI state. We prefer the last symbol of the old TCI state, as below: The UE shall be able to receive PDCCH with the old TCI state until ***symbol #m before***slot n+ THARQ + *+ TOk\*(Tfirst-SSB + TSSB-proc) / NR slot length*.We can go with option 1 as well for Tok=0.  |
| QC | We can support option 1 with the modification on TOk as commented in the previous issue. |
| ZTE | Support Option 1. |
| Samsung | Option 1, but option 1 + Tok=1, no ISI is also okay for us.  |

#### Issue 2-3-3: CSI-RS based RLM and BFD requirements

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| **Agreement:**For CSI-RS based RLM and BFD, there is no standard impact for Rel-17 FR2 HST UE (i.e., FR2 PC6 UE). |

#### Issue 2-3-4 (new): Scheduling restriction on SSB

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| **Way forward (maintenance):**FFS whether the network should not use adjacent SSBs in FR2 HST. |

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| *Background*One additional point we would like to raise on scheduling restriction is on SSB. In 104bis-e, it was agreed that “RAN4 introduce scheduling restriction for the symbol before and after reference symbols used for L1-RSRP measurement. Such scheduling restriction shall be specified in clauses of L1 measurement (i.e., L1-SINR and L1-RSRP)”It is observed that SSB pattern for 120KHz and 240KHz has SSBs adjacent to each other. In 120KHz SCS, 2 SSBs are adjacent to each other, and for 240KHz SCS, 4 SSBs are adjacent to each other. In this case, the inter-symbol interference between different SSBs and the corresponding restriction should apply as well. To minimize L1-RSRP measurement impact and limit specification change, network should not use adjacent SSBs in FR2 HST. For example, in case of 120KHz SCS, network should not use SSB0 and SSB1 together. SSB0 and SSB2, or SSB1 and SSB2 are valid.  *Recommendations for 2nd round:*Companies are encouraged to share their opinion on the Proposal 1. |
| **Company** | **Comments** |
| Ericsson | We suppose it doesn’t impact scheduling restriction for the symbol before and after reference symbols used for L1-RSRP. 71GHz session has similar situation, required scheduling restriction boundary has been in the consecutive SSB symbol. Update:We can support Proposal1. |
| Nokia | As mentioned in Issue 2-3-2, this is needed when UE is moving in the opposite direction to the RRH Tx beams. |
| Apple | We support the proposal. Network should not use adjacent SSBs in this case.  |
| QC | We can support this proposal, but to capture this in spec, should we say the following?FR2 HST requirement is applicable when SSBs are not adjacent.Or we can soften the condition as:FR2 HST requirement is applicable when SSBs from different RRHs are not adjacent.To Ericsson: based on our understanding, the concern here is not scheduling restriction on data reception as 71GHz discussion. When SSB 0 and SSB 1 are overlapping because of propagation delay difference, there could be impact on PSS/SSS detection or PBCH decoding performance. |
| ZTE | Based on the previous agreement referred by the proponent, we can agree Proposal 1. |
| Samsung | P1 works as NW configuration restriction, but we need to discuss how to capture this in the spec.  |
| Nokia2 | Further to our earlier comments, we would like to illustrate a scenario where it is not necessary to avoid two consecutive SSBs. Let us assume RRH1 transmits SSB0 and then followed by RRH2 transmits SSB1. In this case, there is no ISI between adjacent SSB symbols at the switching point. The restriction is deployment scenario dependent, which should be outlined when specifying in specifications.  |

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## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2206851 | **Revision of R4-2204489, Draft CR for Cell re-selection for HST FR2, by ZTE Corporation**Recommended to be agreed.Dear all,Thanks for your comments in 1st round. Please find the revised version of the CR R4-2204489 on Cell re-selection for RRC\_IDLE state for HST FR2: [rev R4-2204489 Draft CR for cell re-selection for RRC\_IDLE state for NR high speed train scenario in FR2\_v1](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/rev%20R4-2204489%20Draft%20CR%20for%20cell%20re-selection%20for%20RRC_IDLE%20state%20for%20NR%20high%20speed%20train%20scenario%20in%20FR2_v1.docx%22%20%5Ct%20%22_self)The additional new changes are highlighted in the CR. The 1st round comments are as provided below.

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| **R4-2204489**, Draft CR for Cell re-selection for HST FR2, by ZTE Corporation |
| **Company** | **Comments** |
| QC | 1. The cell re-selection requirement is for neighboring cell, not serving cell. Even in FR1 HST with 500km/h, we don't have serving cell measurement enhancement in idle mode2. The agreed enhancement is on DRx = 320ms only, the rest should follow legacy instead of FR1 HST scaling factors3. We need to change ""not......or"" to ""neither....nor"" |
| CATT | According to Issue 2-1-1, the enhancement is only for DRX 0.32s. |
| Samsung | Similar to QC, the improvement for Idle mode’s serving cell measurement is not necessary. So changes to Section 4.2.2.2 is not necessary. For intra-frequency measurement, the table can be further refined based on the conclusion from Issue 2-1-1. Furthermore, it is suggested to add “FR2 PC6” to restrict the applicable UE PC in the following revision: “For FR2 power class 6 UE configured with [highSpeedMeasFlagFR2-r17], Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate, NR\_intra are specified in Table 4.2.2.3-3.” |

Best Regards,Chenchen ZHANG  张晨晨**ZTE Corporation** |
| R4-2206852 | **Revision of R4-2204490, Draft CR for L1-RSRP measurements for Reporting for HST FR2, by ZTE Corporation**Recommended to be agreed.Dear Chenchen,Thank you for your reply.Some changes are made to the draft CR and uploaded to [rev R4-2204490 Draft CR for L1-RSRP measurements for Reporting for HST FR2\_v3\_QC\_Nok2\_ZTE.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/rev%20R4-2204490%20Draft%20CR%20for%20L1-RSRP%20measurements%20for%20Reporting%20for%20HST%20FR2_v3_QC_Nok2_ZTE.docx).Regarding the following:For 2), we believe for the case of SMTC > 40ms, N1 should equals to legacy 8, not 2 or 6, the table achieved in 101bis meeting only consider effective cases for HST FR2, not consider the case when SMTC>40ms.The agreement from the RAN4#101bis-e meeting (R4-2202594) and also quoted in your e-mail should be followed. Best Regards,AnthonyNokia **From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Zhang Chenchen**Sent:** Tuesday, March 1, 2022 5:14 PM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2Dear Sean, Yanze and Anthony, Thanks for your comments and discussion.Let me try to summarize, till now we have three concerns about this CR:1) For the case of SMTC>40ms, for the value of scaling factor, does it equals to 1.5 or 1?2) For the case of SMTC>40ms, for the value of N1, does it equals to 2/6 or legacy 8?3) Whether and how to reflect scheduling restriction is only applicable to inter-RRH beam switching not intra-RRH. For 1) and 2), after further check the agreements in 100 meeting and 101bis meeting, we copy the agreements as follows:

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| --- |
| **SMTC periodicity:****Agreement in 100 meeting**HST FR2 enhanced requirement is applied to SMTC <=40ms. SMTC periodicity is not restricted. |
| **L1-RSRP measurements for Reporting:****Agreement:**o For Set 1

|  |  |
| --- | --- |
| **Configuration** | **TL1-RSRP\_Measurement\_Period\_SSB (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*NA)\*TSSB) |
| DRX cycle ≤ 80ms | max(TReport, ceil(M\*P\*NA\*M2)\*max(TDRX,TSSB)) |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

NA = 2o For Set 2

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| **Configuration** | **TL1-RSRP\_Measurement\_Period\_SSB (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*NB)\*TSSB) |
| DRX cycle ≤ 80ms | max(TReport, ceil(M\*P\*NB\*M2)\*max(TDRX,TSSB)) |
| Note: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

NB = 6 |

For 1), we believe “M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1” should be applied. At the same time, which guarantee the case of SMTC > 40ms is possible for HST FR2.For 2), we believe for the case of SMTC > 40ms, N1 should equals to legacy 8, not 2 or 6, the table achieved in 101bis meeting only consider effective cases for HST FR2, not consider the case when SMTC>40ms.For 3), since the inter-RRH indication is not allowed, so UE can not known whether inter-RRH TCI switching happening, so I do not provide any text differentiation regarding the scheduling restriction. To Yanze and Anthony, we use table -2 for the cases of non-HST FR2 and HST FR2 with SMTC>40, since these two cases should apply legacy requirements. We use table -3 for the case of HST FR2 with SMTC>40, since enhancement is only applicable for this case. Which is somehow different with our original version, but we believe it is more clear. Your can further check whether my latest version is fine for you. Any comment is welcome.  [https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR\_HST\_FR2\_RRM\_1/CRs/rev%20R4-2204490%20Draft%20CR%20for%20L1-RSRP%20measurements%20for%20Reporting%20for%20HST%20FR2\_v2\_QC\_Nok\_ZTE.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/rev%20R4-2204490%20Draft%20CR%20for%20L1-RSRP%20measurements%20for%20Reporting%20for%20HST%20FR2_v2_QC_Nok_ZTE.docx%22%20%5Ct%20%22_blank)Best Regards,Chenchen ZHANG  张晨晨**ZTE Corporation**原始邮件**发件人：**Chu-HsiangHuang**收件人：**3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG>;**日 期 ：**2022年03月01日 22:31**主 题 ：Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2**Hi Anthony,There is no legacy scaling factor of 1.5 in the issue associated with the agreement from email summary: Issue 3-1-4: SMTC periodicity1. Proposals and/or Observations
	1. Proposal 1(CMCC): It is not preferred to have restriction on SMTC periodicity for FR2 HST.
	2. Proposal 2(Qualcomm): Only consider SMTC period <= 40ms.

 But since we also have the table mentioned by CATT in the later WF which specifically captures the requirement table, we’ll let the CR owner (ZTE) decide which way to go. Best regards,Sean **From:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com> **Sent:** Tuesday, March 1, 2022 6:19 AM**To:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2 **WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Thanks for your reply, Sean. Checking the Email discussion summary for [100-e][218] NR\_HST\_FR2\_RRM\_1, the agreement below refers to the enhancement of scaling factor 1.5 only. When you say “enhancement doesn’t apply”, it means the legacy scaling factor 1.5 should apply instead of 1 according to our understanding of the discussion summary. **SMTC periodicity**

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| **Agreement:**HST FR2 enhanced requirement is applied to SMTC <=40ms. SMTC periodicity is not restricted. |

  Best Regards,Anthony  **From:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com> **Sent:** Tuesday, March 1, 2022 2:01 PM**To:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2 Hi Anthony and Yanze,Based on our understanding, when we say “enhancement doesn’t apply”, it should refer to legacy requirement. The following agreement is from RAN4#100e: **SMTC periodicity**

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| **Agreement:**HST FR2 enhanced requirement is applied to SMTC <=40ms. SMTC periodicity is not restricted. |

 For the scheduling restriction question, based on our reading, the current text covers both inter and intra RRH cases. Since UE doesn’t know whether it’s intra or inter RRH when measuring L1-RSRP, it’s not possible to distinguish the two under L1-RSRP measurement requirement. Best regards,Sean **From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Lo, Anthony (Nokia - GB/Bristol)**Sent:** Tuesday, March 1, 2022 4:04 AM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2 **WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Dear Chenchen, Others, Thanks for the draft CR. Some comments for the draft CR are uploaded to: [rev R4-2204490 Draft CR for L1-RSRP measurements for Reporting for HST FR2\_v2\_QC\_Nok.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/rev%20R4-2204490%20Draft%20CR%20for%20L1-RSRP%20measurements%20for%20Reporting%20for%20HST%20FR2_v2_QC_Nok.docx%22%20%5Ct%20%22_blank) We share the same view as CATT regarding SMTC > 40 ms. On scheduling restriction, it’s not clear if the proposed text is only applicable to inter-RRH beam switching or both inter-RRH and intra-RRH beam switching. Could you please clarify? Best Regards,AnthonyNokia  **From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Yanze Fu**Sent:** Tuesday, March 1, 2022 7:15 AM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2 Dear Sean and Chenchen,  According to the agreement in RAN4-101-bis-e (WF R4-2202594), our understanding is different from Qualcomm’s version. If follow this agreements, when SMTC>40ms, the requirement is different from the legacy requirement. Could you please check whether we have the same understanding? Thank you.

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| **Agreement:*** 1. For Set 1

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| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*NA)\*TSSB) |
| DRX cycle ≤ 80ms | max(TReport, ceil(M\*P\*NA\*M2)\*max(TDRX,TSSB)) |
| Note 1:     TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

NA = 2* 1. For Set 2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*NB)\*TSSB) |
| DRX cycle ≤ 80ms | max(TReport, ceil(M\*P\*NB\*M2)\*max(TDRX,TSSB)) |
| Note:        TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

NB = 6 |

 BR,Yanze **From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 [mailto:3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG] **On Behalf Of** Chu-Hsiang Huang**Sent:** Monday, February 28, 2022 1:45 PM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2 Hi Chenchen,Thank you for addressing our comments. However, we found an issue in the revised version: SMTC > 40ms when HST flag is configured, the requirement is different than legacy requirement, which is against the previous agreement. For example, when SMTC > 40ms, non-DRx and set 2 is configured, the requirement is:max(TReport, ceil(M\*P\*N)\*TSSB), N =6.However, legacy requirement is :max(TReport, ceil(M\*P\*N)\*TSSB), N = 8. To resolve this issue, we propose a new version : https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR\_HST\_FR2\_RRM\_1/CRs/rev%20R4-2204490%20Draft%20CR%20for%20L1-RSRP%20measurements%20for%20Reporting%20for%20HST%20FR2\_v2\_QC.docx Could you please check if the new version aligned with your understanding and the agreement? Thank you. Best regards,Sean **From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Zhang Chenchen**Sent:** Friday, February 25, 2022 7:18 PM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - Draft CR for L1-RSRP measurements for Reporting for HST FR2 **WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Dear all, Thanks for your comments in 1st round. Please find the revised version of the CR R4-2204490 on L1-RSRP measurements for Reporting for HST FR2: [rev R4-2204490 Draft CR for L1-RSRP measurements for Reporting for HST FR2\_v1](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/rev%20R4-2204490%20Draft%20CR%20for%20L1-RSRP%20measurements%20for%20Reporting%20for%20HST%20FR2_v1.docx%22%20%5Ct%20%22_blank)The additional new changes are highlighted in the CR.  The 1st round comments are as provided below.

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| **R4-2204490**, Draft CR for L1-RSRP measurements for Reporting for HST FR2, by ZTE Corporation |
| **Company** | **Comments** |
| QC | 1. highSpeedMeasFlagFR2-r17 can not be both FR2 HST rrm flag and requirement set IE2. Why change in sharing factor is needed?3. Note 2 can be removed4. ""When SMTC <= 40ms"" should be added before ""N=2 when [highSpeedMeasFlagFR2-r17] "", and note 3 and M2 can also be removed, since M2 = 1 when SMTC is <= 40. In RAN4#100e, we agreed that FR2 HST enhancement is applicable to SMTC <= 40ms only. |
| Samsung | The relevant changes should be applicable to FR2 PC6 when highSpeedMeasFlagFR2-r17 is configured. So “FR2 PC6” is needed to be added as our comment to other CR.Also need the changes to scheduling restriction as Huawei did for L1-SINR.  |

   Best Regards,Chenchen ZHANG  张晨晨**ZTE Corporation** |
| R4-2206853 | **Revision of R4-2204629, CR to TS 38.133: intra-frequency measurements without gaps for for FR2 NR HST, by Nokia, Nokia Shanghai Bell**Recommended to be agreed.Hi Anthony,As you quoted below, the discussion and agreement are not limited to scaling factor of 1.5. It is a generic agreement. Therefore, it applies to all the neighboring cell measurement components.Issue 3-1-4: SMTC periodicity* Proposals and/or Observations
	+ Proposal 1(CMCC): It is not preferred to have restriction on SMTC periodicity for FR2 HST.
	+ Proposal 2(Qualcomm): Only consider SMTC period <= 40ms.

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| **Company** | **Comments** |
| QC | Our motivation is to limit the SMTC and DRx for deriving the requirement in mobility analysis. Hence proposal 2 can revise as deriving the requirement under the assumption of SMTC period <= 40ms, but not restricting SMTC period in FR2 HST. |
| Nokia | Proposal 1 is Ok. |
| Ericsson | Agree with Proposal 1. Fine with QC’s explanation.  |
| Samsung | P2 are okay to us, i.e., no need to define requirement for SMTC period longer than 40ms, which does not conflict with P1.  |
| Intel  | Agree with QC. We need the limits for requirements derivation. 40ms can be considered |
| Apple | Similar to FR1 HST, enhanced requirement is applied to SMTC <=40ms. This align with 3.2.1.3 option 1 |
| CATT | Prefer proposal 1. And similar enhancement of the requirements of SMTC period 40ms as the boundary.   |
| CMCC | Proposal 1 is proposed not to have restriction on the network configuration. But for the requirements derivation, we are OK with proposal 2. |
| ZTEE | Support Proposal 1. |

Best regards,Sean**From:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com> **Sent:** Tuesday, March 1, 2022 6:34 AM**To:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204629**WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Thanks for your reply, Sean.We are fine with “when SMTC > 40 ms, the legacy requirement applies” if legacy refers to the scaling factor 1.5 only. Best Regards,Anthony **From:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com> **Sent:** Tuesday, March 1, 2022 1:46 PM**To:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204629Hi Anthony,We don’t restrict the SMTC periodicity. Network can configure SMTC > 40m. When SMTC > 40ms, the legacy requirement applies.Best regards,Sean**From:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com> **Sent:** Tuesday, March 1, 2022 2:56 AM**To:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204629**WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Hi Sean,Thanks for your comments.If the FR2 HST enhancement can apply only when both conditions (SMTC <= 40ms and DRx <=80ms) hold, then it is not in line with “SMTC periodicity is not restricted” in the agreement that you quoted:**SMTC periodicity**

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| **Agreement:**HST FR2 enhanced requirement is applied to SMTC <=40ms. SMTC periodicity is not restricted. |

Our understanding of the above agreement is that network configuration should not be restricted. Based on your comments, the FR2 HST enhancements only applicable to SMTC <= 40 ms, which would restrict network configuration. This is also not in line with discussions on SMTC periodicity (in RAN4 #100-4 - Email discussion summary for [100-e][218] NR\_HST\_FR2\_RRM\_1), which says the SMTC <= 40 ms is used for deriving the requirement, but not restricting SMTC period as shown below:Issue 3-1-4: SMTC periodicity* Proposals and/or Observations
	+ Proposal 1(CMCC): It is not preferred to have restriction on SMTC periodicity for FR2 HST.
	+ Proposal 2(Qualcomm): Only consider SMTC period <= 40ms.

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| **Company** | **Comments** |
| QC | Our motivation is to limit the SMTC and DRx for deriving the requirement in mobility analysis. Hence proposal 2 can revise as deriving the requirement under the assumption of SMTC period <= 40ms, but not restricting SMTC period in FR2 HST. |
| Nokia | Proposal 1 is Ok. |
| Ericsson | Agree with Proposal 1. Fine with QC’s explanation.  |
| Samsung | P2 are okay to us, i.e., no need to define requirement for SMTC period longer than 40ms, which does not conflict with P1.  |
| Intel  | Agree with QC. We need the limits for requirements derivation. 40ms can be considered |
| Apple | Similar to FR1 HST, enhanced requirement is applied to SMTC <=40ms. This align with 3.2.1.3 option 1 |
| CATT | Prefer proposal 1. And similar enhancement of the requirements of SMTC period 40ms as the boundary.   |
| CMCC | Proposal 1 is proposed not to have restriction on the network configuration. But for the requirements derivation, we are OK with proposal 2. |
| ZTEE | Support Proposal 1. |

We would like to hear more views from RAN4. Best Regards,Anthony**From:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com> **Sent:** Tuesday, March 1, 2022 1:02 AM**To:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204629Hi Anthony,The agreement is from RAN4#100-e WF:**SMTC periodicity**

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| **Agreement:**HST FR2 enhanced requirement is applied to SMTC <=40ms. SMTC periodicity is not restricted. |

Our understanding of the agreement you quoted is M2=1.5, the same as legacy requirement.**Way forward from GtW:*** Baseline: M2 = 1.5 if SMTC periodicity > [40] ms, otherwise M2=1
	+ FFS if a different scaling factor is needed for scenario-B with two-side RRH

Since we agreed enhancement applied to SMTC <= 40ms and DRx <=80ms separately, the FR2 HST enhancement can apply only when both conditions hold. Therefore, we still believe our comment should be addressed. Thank you for preparing the draft and addressing our comments.Best regards,Sean**From:** Lo, Anthony (Nokia - GB/Bristol) <anthony.lo@nokia.com> **Sent:** Monday, February 28, 2022 3:41 AM**To:** Chu-Hsiang Huang <chuhsian@qti.qualcomm.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204629**WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Thanks for your feedback, Sean.[QC]: Could you clarify how you address our comment on applicable SMTC period? In your table, when SMTC > 40ms and non-DRx, the measurement requirement is:max(400ms, ceil(M1Note 2 x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintraHowever, the requirement for SMTC > 40ms should be the same as legacy:max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintraIn our revised draft CR, when SMTC > 40 ms and non-DRX, the measurement requirement is those in yellow below:

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra   |
| No DRX | max(400ms, ceil(M1Note 2 x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 80ms | max(400ms, ceil(M1Note 2 x M2Note 3 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| 80ms< DRX cycle≤ 320ms | ceil(M2Note 3 x Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle) x CSSFintra  |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps xKp x Klayer1\_measurement ) x DRX cycle x CSSFintra |
| 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:   For UE supporting power class 6, M1= 6 if [*highSpeedMeasFlagFR2-r17* = set1] or M1= 18 if [*highSpeedMeasFlagFR2-r17* = set2]NOTE 3:   M2 = 1 if SMTC periodicity ≤ 40 ms; otherwise M2 = 1.5 |

The requirement is the same as legacy when DRX > 80 ms, which is in line with the agreements of the RAN4 #100-e meeting below:**DRX upper bound for enhanced RRM HST FR2 requirements**

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| **Agreement:**Baseline: DRX upper bound for enhanced RRM HST FR2 requirements is [80]ms.**Way forward:**FFS, whether different requirements shall be defined for requirement Set1 and Set 2. |

**M2 scaling factor for short DRX**

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| **Way forward from GtW:*** Baseline: M2 = 1.5 if SMTC periodicity > [40] ms, otherwise M2=1
	+ FFS if a different scaling factor is needed for scenario-B with two-side RRH
 |

Based on the above agreements, when DRX <= 80 ms, the measurement requirement should follow the enhancement for HST (for SMTC > 40 ms and SMTC <= 40 ms ) and not the legacy.We want to hear form RAN4 in case we’ve a different understanding.Best Regards,Anthony**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Chu-Hsiang Huang**Sent:** Monday, February 28, 2022 6:06 AM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204629Hi Anthony,Could you clarify how you address our comment on applicable SMTC period? In your table, when SMTC > 40ms and non-DRx, the measurement requirement is:max(400ms, ceil(M1Note 2 x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintraHowever, the requirement for SMTC > 40ms should be the same as legacy:max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintraCould you address that? We suggest to revise the table title (and measurement requirement also follows):Table 9.2.5.1-11: Time period for PSS/SSS detection when [*highSpeedMeasFlagFR2-r17*] is configured and SMTC <= 40ms, (Frequency range FR2)Then Note 3 and M2 can be removed.Best regards,Sean**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Lo, Anthony (Nokia - GB/Bristol)**Sent:** Friday, February 25, 2022 3:16 AM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204629**WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Dear Dmitry and Others,Please be informed the draft revision of the below draft CR is uploaded to: [REV OF R4-2204629 CR to 38.133 - FR2 HST meas v1.docx](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/REV%20OF%20R4-2204629%20CR%20to%2038.133%20-%20FR2%20HST%20meas%20v1.docx)

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| R4-2204629 | CR to TS 38.133: intra-frequency measurements without gaps for for FR2 NR HST | Nokia, Nokia Shanghai Bell | Revised |

The changes in relation to the original version are:QC’s comments:3. Since in RAN4#100e, we agreed that FR2 HST enhancement is applicable to SMTC <= 40ms, Note 3 should be replaced by this table is applicable to SMTC <= 40ms.CATT’s comments:

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| --- | --- |
| 80ms< DRX cycle≤ 320ms  | ~~max(600ms,~~ ceil(M2 x Mpss/sss\_sync\_w/o\_gaps  x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra  |

Further comments are welcome!Best Regards,AnthonyNokia |
| R4-2206854 | **Revision of R4-2204895, Scheduling restriction for L1-SINR for FR2 HST, by Huawei, Hisilicon**Recommended to be agreed.Dear Jing and Anthony,Thanks for the revision and discussion. Although I provided a revision v02 after Nokia’s, I think Han Jing’s original comment is very reasonable, that, is the part not necessary.With that, we are fine with Han Jing’s original version, and pls. ignore our revision in the inbox. In the next meeting, we will bring Cat-F CR to correct Rel-16 eMIMO’s L1-SINR’s issue (by removing the below red part), which will generate Cat-A CR for the first paragraph.  For Anthony’s comment, I have the same understanding as Han Jing, i.e., no inter-RRH indication is introduced, so we can’t discriminate them apart. Accordingly, the CR provided by Han Jing is aligned with this understanding. Regards,Jackson (He Wang)**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 [mailto:3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG] **On Behalf Of** Hanjing (Hw)**Sent:** 2022年3月1日 22:51**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204895Dear Anthony,Thanks for your comments.In my understanding, UE don’t know whether it is inter-RRH or intra-RRH when UE performs L1-SINR measurement (if RAN4 agree on a scheme to let UE know this, it is fine to distinguish inter-RRH, intra-RRH cases). BR,Han Jing**From:** Lo, Anthony (Nokia - GB/Bristol) [mailto:anthony.lo@nokia.com] **Sent:** Tuesday, March 1, 2022 8:37 PM**To:** Hanjing (Hw) <hw.hanjing@huawei.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204895Dear Jing,Thanks for your draft CR. Some comments are uploaded to [Revised R4-2204895 L1-SINR scheduling restriction v01\_Nok.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/Revised%20R4-2204895%20L1-SINR%20scheduling%20restriction%20v01_Nok.docx).We appreciate if you could clarify our comments.Best Regards,AnthonyNokia**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Hanjing (Hw)**Sent:** Monday, February 28, 2022 1:41 AM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft revision of R4-2204895Dear all,Please find the revised CR on L1-SINR scheduling restriction at [Revised R4-2204895 L1-SINR scheduling restriction v01.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/Revised%20R4-2204895%20L1-SINR%20scheduling%20restriction%20v01.docx).As Samsung would like to provide a CR for next meeting to fix the typo in the legacy requirements, I keep the scheduling restriction unchanged for non-FR2 PC6 case. For the FR2 PC6 case, the corresponding corrections were captured in the revised CR.One thing I would like to point out that, the part is not necessary to be added, as this is for measurement not for data reception. (the part is more like a measurement restriction).==== quoted from Samsung’s comments===The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI/CSI-RS for L1-RSRP measurement on the ~~CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR, and on 1 data symbol before ~~each CSI-RS for L1-RSRP measurement symbols to be measured for L1-SINR~~ and 1 data symbol after ~~each CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR for FR2 power class 6 UE configured with [highSpeedMeasFlagFR2-r17]~~in HST scenario~~.==

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| **R4-2204895**, Scheduling restriction for L1-SINR for FR2 HST, by Huawei, Hisilicon |
| **Company** | **Comments** |
| **Company** | **Comments** |
| Samsung | We realized that there is an typo for existing L1-SINR requirement for scheduling restriction. The red part needs to be corrected, but it should be introduced by a Rel-16 maintenance CR (as Rel-16 eMIMO rapporteur, we can prepare that in the next meeting). For others, we can introduce in this CR by emphasize the requirement is only applicable to FR2 PC6 UE.  -     The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI/CSI-RS for L1-RSRP measurement on the ~~CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR ~~in non-HST scenario~~ for FR2 power class 6 UE not configured with [highSpeedMeasFlagFR2-r17], and for UE not supporting FR2 power class 6;.-    The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI/CSI-RS for L1-RSRP measurement on the ~~CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR, and on 1 data symbol before ~~each CSI-RS for L1-RSRP measurement symbols to be measured for L1-SINR~~ and 1 data symbol after ~~each CSI-RS for L1-RSRP measurement~~ symbols to be measured for L1-SINR for FR2 power class 6 UE configured with [highSpeedMeasFlagFR2-r17]~~in HST scenario~~. |
| Nokia | Pending the outcome of Issue 2-3-2.  |

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| R4-2206855 | **Revision of R4-2203901, Draft CR on RLM/BFD requirement for FR2 HST, by CATT**Recommended to be agreed.Dear Jackson and Yanze,What we consider is that  for PC6 there are special requirements for some cases e.g. RLM/BFD. Another option is to add it in general applicability section with reference to BFD section we can do that clean up later in next meeting.Can we agree on that option?Best RegardsMing Li**From:** He Wang (Jackson) <h0809.wang@samsung.com> **Sent:** den 2 mars 2022 10:59**To:** Ming Li L <ming.l.li@ericsson.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTDear Ming,Simple question, for PC1, we also don’t have DC case, but we don’t have such sentence in RRM spec to restriction.Why we have the restriction for PC6? With or without this sentence, the specific UE’s requirement to be applicable is the same. We prefer to have the v5 version. Regards,Jackson (He Wang)**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 [mailto:3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG] **On Behalf Of** Ming Li L**Sent:** 2022年3月2日 15:36**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTHello,CATT’s revision is fine with us.We suggest to add this sentences still. Radio specification isn’t a straightforward reference to justify validity of uses case.Even we know it with respect to WI, but it’s not clear to readers. This sentence can reflect scope of WI.Best RegardsMing Li**From:** He Wang (Jackson) <h0809.wang@samsung.com> **Sent:** den 2 mars 2022 07:45**To:** fuyanze@CATT.CN; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG; Ming Li L <ming.l.li@ericsson.com>**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTDear Yanze, Ming a.o,Thanks for the drafting and discussion. However, I don’t believe the below sentence (or similar one) is needed for the three clauses:      “For FR2 power class 6 UE, the requirements in this clause are applicable only for beam failure detection on the PCell.”For PC6, yes, it is designed to be used for SA single carrier scenario as required in Rel-17 WID. However, in RF specification, we have not introduced requirement for CA or DC case, so it is a more straightforward restriction for PC6 only working as SA single carrier case. For instance, for PC1, we also don’t have DC case, but we still don’t have such sentence in RRM spec to restriction. In short, to give restriction in RF spec is more straightforward method. From the opposite perspective, without this sentence, we don’t see any problem at all. Pls. find the below revision by removing the three sentence within. [DRAFT\_R4-2206855(rev fromR4-2203901) Draft CR on RLMBFD requirement for FR2 HST\_v5\_CATT\_Samsung.docx](https://protect2.fireeye.com/v1/url?k=31323334-501d5122-313273af-454445555731-6f18e067eea39cf6&q=1&e=15214ea8-9413-4d25-beb5-2b2a0b94723b&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FWG4_Radio%2FTSGR4_102-e%2FInbox%2FDrafts%2F%255B102-e%255D%255B212%255D%2520NR_HST_FR2_RRM_1%2FCRs%2FDRAFT_R4-2206855%28rev%2520fromR4-2203901%29%2520Draft%2520CR%2520on%2520RLMBFD%2520requirement%2520for%2520FR2%2520HST_v5_CATT_Samsung.docx)Regards,Jackson (He Wang)**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 [mailto:3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG] **On Behalf Of** Yanze Fu**Sent:** 2022年3月2日 1:23**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTDear Ming and Sean,  Thank you for drafting. We draft a new version : [DRAFT\_R4-2206855(rev fromR4-2203901) Draft CR on RLMBFD requirement for FR2 HST\_v4\_CATT.docx](https://protect2.fireeye.com/v1/url?k=31323334-501d5122-313273af-454445555731-2ee9af464b74b06d&q=1&e=15214ea8-9413-4d25-beb5-2b2a0b94723b&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FWG4_Radio%2FTSGR4_102-e%2FInbox%2FDrafts%2F%255B102-e%255D%255B212%255D%2520NR_HST_FR2_RRM_1%2FCRs%2FDRAFT_R4-2206855%28rev%2520fromR4-2203901%29%2520Draft%2520CR%2520on%2520RLMBFD%2520requirement%2520for%2520FR2%2520HST_v4_CATT.docx). Could you please check with the latest version? Thank you. BR,Yanze**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 [mailto:3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG] **On Behalf Of** Ming Li L**Sent:** Wednesday, March 2, 2022 12:22 AM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTHello Sean and Yanze,Yes, no enhancement for CBD.Regarding Yanze’s concern, we can remove DRX part and keep necessary statements. We updated revision as below:[https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D NR\_HST\_FR2\_RRM\_1/CRs/DRAFT\_R4-2206855(rev fromR4-2203901) Draft CR on RLMBFD requirement for FR2 HST\_v2\_ Ericsson2.docx](https://protect2.fireeye.com/v1/url?k=31323334-501d5122-313273af-454445555731-477c1076adc51a00&q=1&e=15214ea8-9413-4d25-beb5-2b2a0b94723b&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FWG4_Radio%2FTSGR4_102-e%2FInbox%2FDrafts%2F%255B102-e%255D%255B212%255D%2520NR_HST_FR2_RRM_1%2FCRs%2FDRAFT_R4-2206855%28rev%2520fromR4-2203901%29%2520Draft%2520CR%2520on%2520RLMBFD%2520requirement%2520for%2520FR2%2520HST_v2_%2520Ericsson2.docx)Best RegardsMing Li**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Chu-Hsiang Huang**Sent:** den 1 mars 2022 15:19**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTHi Yanze and Ming,Thank you for the discussion on this CR. As we commented in the first round, the agreement is no enhancement for CBD. Therefore, no change should be made to Ch 8.5.Best regards,Sean**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Yanze Fu**Sent:** Tuesday, March 1, 2022 12:51 AM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HST**WARNING:** This email originated from outside of Qualcomm. Please be wary of any links or attachments, and do not enable macros.Dear Ming,  Thank you very much for the comments. As this feature is only for SA single carrier, we are fine with the modification for the applicability to PCell in Ch 8.1.2 and 8.5.2 and 8.5.5.1. But for Ch 8.5.5.2, we suggest not to add the green part. To our understanding, if DRX cycle is above the upper bound of DRX cycle, the existing R16 requirements should be applied for long DRX cycles according to the previous agreements. If follow the green part, it is not clear which requirements should be followed when DRX is larger than 80ms. There is no such definition. What’s your opinion? Thank you. 8.5.5.2          Minimum requirementUpon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set  estimated over the last TEvaluate\_CBD\_SSB ms period becomes better than the threshold Qin\_LR provided SSB\_RP and SSB Ês/Iot are according to Annex Table B.2.4.1 for a corresponding band.The UE shall monitor the configured SSB resources using the evaluation period in table 8.5.5.2-1 and 8.5.5.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms. The requirement for FR2 power class 6 UE configured with [highSpeedMeasFlagFR2-r17] is only applicable to the configuration with no DRX or DRX cycle≤80ms.The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-1 for FR1.The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-2 for FR2 with scaling factor N=8. For FR2 UE power classe 6 configured with [highSpeedMeasFlagFR2-r17], N=8.where,Best Regards,Yanze**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 [mailto:3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG] **On Behalf Of** Ming Li L**Sent:** Monday, February 28, 2022 7:05 PM**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTDear Yanze,Thanks for updated CR.We did some minor updates based on below reasons:* We suppose FR2 HST applies only to PCell, thus we shall separate changes from current RLM for PCell PSCell,  BFD/CBD applies to Pcell, PScell, and Scell.
* For PC6 FR2 we have different BFD/RLM requirements for PC6 PC2, thus there will be confusion as if what CBD applies for PC6 PC2. Also we need ensure BFD applies only on PCell and with DRX <= 80 ms.

The detailed updates can be found:[DRAFT\_R4-2206855(rev fromR4-2203901) Draft CR on RLMBFD requirement for FR2 HST\_v1\_ Ericsson.docx](https://protect2.fireeye.com/v1/url?k=31323334-501d5122-313273af-454445555731-8226b75f6146a064&q=1&e=15214ea8-9413-4d25-beb5-2b2a0b94723b&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FWG4_Radio%2FTSGR4_102-e%2FInbox%2FDrafts%2F%255B102-e%255D%255B212%255D%2520NR_HST_FR2_RRM_1%2FCRs%2FDRAFT_R4-2206855%28rev%2520fromR4-2203901%29%2520Draft%2520CR%2520on%2520RLMBFD%2520requirement%2520for%2520FR2%2520HST_v1_%2520Ericsson.docx)Best RegardsMing Li**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 <3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG> **On Behalf Of** Yanze Fu**Sent:** den 28 februari 2022 06:37**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - draft CR on RLM/BFD requirement for FR2 HSTDear Dmitry and all,  Please find the draft revision of below draft CR in : [DRAFT\_R4-2206855(rev fromR4-2203901) Draft CR on RLMBFD requirement for FR2 HST.docx](https://protect2.fireeye.com/v1/url?k=31323334-501d5122-313273af-454445555731-254285a64815683a&q=1&e=15214ea8-9413-4d25-beb5-2b2a0b94723b&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FWG4_Radio%2FTSGR4_102-e%2FInbox%2FDrafts%2F%255B102-e%255D%255B212%255D%2520NR_HST_FR2_RRM_1%2FCRs%2FDRAFT_R4-2206855%28rev%2520fromR4-2203901%29%2520Draft%2520CR%2520on%2520RLMBFD%2520requirement%2520for%2520FR2%2520HST.docx)

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| R4-2203901 | Draft CR on RLM/BFD requirement for FR2 HST | CATT | Revised |  |

  The changes captured the comments in 1st round discussion.

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| **R4-2203901**, Draft CR on RLM/BFD requirement for FR2 HST, by CATT |
| **Comments** |   |
| RX beam number is 8 with respect to previous agreements.Suggest changing to ‘The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-2 for FR2 power class 6, scaling factor N=8 when [enable high speed measurement for FR2] is configured’ |   |
| QC: It was agreed in RAN4#101e: No enhancement on CBD requirements for DRX <=80ms, the CBD part should be removed |   |
| Fine to remove “Third change” of Ch8.5.5 due to the agreement:**For CBD requirements**o   No enhancement on CBD requirements for DRX <=80ms |   |
| The relevant changes should be applicable to FR2 PC6 when highSpeedMeasFlagFR2-r17 is configured. So “FR2 PC6” is needed to be added as our comment to other CR. Accordingly, the following revision is suggested: TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-2 for FR2 with scaling factor N=8, for FR2 power classes other than power class 6 or [highSpeedMeasFlagFR2-r17] is not configured.TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-2 for FR2 power class 6 UE with [highSpeedMeasFlagFR2-r17] configured, scaling factor N=2 when ~~[enable high speed measurement for FR2] is configured and [RRM requirement for Sets] is configured and set~~ [highSpeedMeasFlagFR2-r17] is configured to [set1], scaling factor N=6 when ~~[enable high speed measurement for FR2] is configured and [RRM requirement for Sets] is configured and set~~ [highSpeedMeasFlagFR2-r17] is configured to [set2]. The requirement for power class 6 is only applicable to the configuration with no DRX or DRX cycle≤80ms. |   |

Thanks!BR, YanzeCATT |
| R4-2206856 | **Revision of R4-2205894, Draft CR to introduce active TCI state switching delay requirement for FR2 HST UE, by Samsung**Recommended to be agreed.Dear Dmitry,Thanks for the revision, which is reasonable proposal and very helpful correction. We are of course fine with the revision. Regards,Jackson (He Wang)**From:** 3gpp\_tsg\_ran\_wg4: tsg ran working group 4 [mailto:3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG] **On Behalf Of** Petrov, Dmitry (Nokia - FI/Espoo)**Sent:** 2022年3月2日 17:25**To:** 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** Re: [102-e][212] NR\_HST\_FR2\_RRM\_1 - dCR on active TCI switching delayDear Jackson,Thank you for the preparation of the CR!We made two small editorial corrections and also renamed the Clause title from PC6 UEs to HST FR2 scenarios:[(Draft)R4-2206856\_draftCR\_FR2 HST\_ActiveTCISwitching\_v01\_Nokia.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/%28Draft%29R4-2206856_draftCR_FR2%20HST_ActiveTCISwitching_v01_Nokia.docx)In our view,  the text already specifically referrers to PC 6 UEs.In this WI we focus specifically on HST FR2 scenarios but we do not know who PC6 UEs will be used in the future.Kind regards,Dmitry**From:** He Wang (Jackson) <h0809.wang@samsung.com> **Sent:** Tuesday, March 1, 2022 19:51**To:** Petrov, Dmitry (Nokia - FI/Espoo) <dmitry.a.petrov@nokia-bell-labs.com>; 3GPP\_TSG\_RAN\_WG4@LIST.ETSI.ORG**Subject:** RE: [102-e][212] NR\_HST\_FR2\_RRM\_1 - dCR on active TCI switching delayDear all,Based on GTW discussion, we have the agreement on TCI switching delay requirement. Furthermore, I’ve tried to provide the TP to address all companies’ preference for Issue 2-3-2: Inter-symbol interference during TCI switching. Pls. find the dCR in the following location: [(Draft)R4-2206856\_draftCR\_FR2 HST\_ActiveTCISwitching\_v00.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B212%5D%20NR_HST_FR2_RRM_1/CRs/%28Draft%29R4-2206856_draftCR_FR2%20HST_ActiveTCISwitching_v00.docx)Copied here for your convenience:

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| 8.10.3a MAC-CE based TCI state switch delay for Power Class 6 UEFor FR2 power class 6 UE*,* if the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the symbol m of the first slot that is after slot n+ THARQ + + TOk\*(Tfirst-SSB + TSSB-proc + Trs + Trs-proc) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ + .Where THARQ is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]; -    Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE;-    TSSB-proc = 2 ms; -    Trs is time to the first TRS or SSB transmission after the SSB transmission in the definition of Tfirst-SSB is processed by the UE;-    Trs-proc = 2 ms;-    TOk = 1, m = 0 if target TCI state is not in the active TCI state list for PDSCH; otherwise TOk = 0, m = 1.For FR2 power class 6 UE, if the target TCI state is unknown, the same requirement for unknown target TCI state case specified in clasue 8.10.3 applies.   |

Comments are welcomed. Regards,Jackson (He Wang) |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
| WF on FR2 HST RRM (part 1) | Nokia, Nokia Shanghai Bell |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2203714 | TP to TR 38.854 on the Number of Rx beams | Qualcomm | Revised |  |
| R4-2204721 | draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM | Ericsson | Revised |  |
| R4-2205896 | TP to TR 38.854 – beam coverage for FR2 HST | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2204489 | Draft CR for Cell re-selection for HST FR2 | ZTE Corporation | Revised |  |
| R4-2204490 | Draft CR for L1-RSRP measurements for Reporting for HST FR2 | ZTE Corporation | Revised |  |
| R4-2204629 | CR to TS 38.133: intra-frequency measurements without gaps for for FR2 NR HST | Nokia, Nokia Shanghai Bell | Revised |  |
| R4-2204895 | Scheduling restriction for L1-SINR for FR2 HST | Huawei, Hisilicon | Revised |  |
| R4-2205960 | TP to TR 38.854 on Legacy RRM Requirement Mobility Performance in HST FR2 Deployment Scenarios | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2205961 | TP to TR 38.854 on Analysis of Mobility Performance in HST FR2 Deployment Scenarios | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2203901 | Draft CR on RLM/BFD requirement for FR2 HST | CATT | Revised |  |
| R4-2205894 | Draft CR to introduce active TCI state switching delay requirement for FR2 HST UE | Samsung | Revised |  |

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

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| --- | --- | --- | --- | --- |
| **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 |  |
| R4-2206849 | TP to TR 38.854 on the Number of Rx beams | Qualcomm | Agreeable |  |
| R4-2206850 | draft CR On RRC\_CONNECTED state mobility for HST FR2 RRM | Ericsson | Agreeable |  |
| R4-2206851 | Draft CR for Cell re-selection for HST FR2 | ZTE Corporation | Agreeable |  |
| R4-2206852 | Draft CR for L1-RSRP measurements for Reporting for HST FR2 | ZTE Corporation | Agreeable |  |
| R4-2206853 | CR to TS 38.133: intra-frequency measurements without gaps for for FR2 NR HST | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2206854 | Scheduling restriction for L1-SINR for FR2 HST | Huawei, Hisilicon | Agreeable |  |
| R4-2206855 | Draft CR on RLM/BFD requirement for FR2 HST | CATT | Agreeable |  |
| R4-2206856 | Draft CR to introduce active TCI state switching delay requirement for FR2 HST UE | Samsung | Agreeable |  |
| R4-2206848  | WF on FR2 HST RRM (part 1) | Nokia, Nokia Shanghai Bell | Agreeable |  |

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

# Annex

**Contact information**

|  |  |  |
| --- | --- | --- |
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Note:

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