**3GPP TSG-RAN WG4 Meeting # 95-e R4-200XXXX**

**Electronic Meeting, 25 May – 5 June, 2020**

**Agenda item:** 6.1.5.2, 6.1.5.8, 6.1.5.9, 6.1.5.10, 6.1.5.13

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

**Title:** Email discussion summary for [95e][205] NR\_unlic\_RRM\_2

**Document for:** Information

# Introduction

This document is the email discussion summary for [95e][205] NR\_unlic\_RRM\_2 with the following topics covered

* Topic 1: Cell re-selection (AI 6.1.5.2)
* Topic 2: Interruptions due to operation in non-NR-U serving cells (AI 6.1.5.8)
* Topic 3: Active BWP switching (AI 6.1.5.9)
* Topic 4: RLM and link recovery procedures (AI 6.1.5.10)
* Topic 5: Timing (AI 6.1.5.13)

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

* 1st round: Decide on the scope, priority, options and tentative agreement to be discussed in the 2nd round. Conclude issues with strict consensus, if any.
* 2nd round: Conclude the issues identified in the 1st round.

# Topic #1: Cell re-selection (AI 6.1.5.2)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2006152](file:///D:\Docs\R4-2006152.zip) | Qualcomm Incorporated | **Observation 1**. In the initial acquisition stage, UE cannot reliably decide on the presence or absence of an SSB based on a single sample (SMTC occasion).  **Proposal 1**. Ms is the number of DRX cycles with at least one SMTC where SSBs are unavailable at the UE during Nserv (i.e, N2 = 1).  **Observation 2**. In the detection stage, UE cannot reliably decide on the presence or absence of an SSB based on a single sample (SMTC occasion). If it could, then R15 requirements would have used one sample for the identification stage.  **Observation 3**. Mandating a UE that operates in unlicensed spectrum to always monitor all candidate SSB positions during measurement and evaluation phases results in increased power consumption compared to a R15 UE. In addition, in many deployments such as Industrial IoT or FBE, the rate of CCA failure is quite low.  **Proposal 2**. For semi-static channel access mode, N2 = 1 in intra-frequency and inter-frequency neighbor cell detection, measurement, and evaluation, i.e., UE considers an SMTC occasion unavailable if the SSB index of the identified cell at the detected SSB position index is not available.  **Proposal 3**. Do not define the target carrier/cell that UE should initiate detection after reaching N unsuccessful measurement attempts.  **Proposal 4**. The number of unsuccessful measurement attempts due to exceeding the max number of unavailable SMTC occasions, N, to not be more than 2. |
| [R4-2007701](file:///D:\Docs\R4-2007701.zip) | Huawei, Hisilicon | **Proposal 1**: After 4 unsuccessful measurement attempts due to exceeding the max number of unavailable SMTC occasions, UE shall restart the detection the cell shall not be considered as a detected cell.  **Proposal 2**: The paging interruption time shall be extend by unavailable SMTC of target cell as : TSI,CCA + (2+L)\*[Ttarget\_cell\_SMTC\_period], where L is number of the unavailable SMTC of target cell and L≤Lmax, and the value of Lmax is FFS.  **Proposal 3**: Upon exceeding Lmax, UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].  **Proposal 4**: RAN4 shall wait for the reply from RAN1 about the SSB monitoring capabilities [2] before discussing the definition of unavailable SMTC/SSB. |
| [R4-2007894](file:///D:\Docs\R4-2007894.zip) | Ericsson | **Proposal #1:** RAN4 shall wait for reply LS regarding the number of SS/PBCH block indexes to monitor.  **Proposal #2:** No impact on parameter Ttarget\_cell\_SMTC\_period in the paging requirements due to LBT  **Proposal #3:** The number of times the UE is allowed to fail the measurement attempts (N) is set to 3.  **Proposal #4:** The UE shall initiate the cell selection procedure for the selected PLMN if the UE fails to detect any suitable cell on any of the configured non-serving carriers for 10 s. |

Moderator: CRs are moved to Section 1.3.2

## Open issues summary

### Cell re-selection

**Issue 1-1: Definition of unavailable SMTC/SSB**

* Proposals
  + Option 1: (Huawei, Ericsson)
    - Wait for RAN1 reply to R4-2005418 before further discussion
  + Option 2: (Qualcomm)
    - For semi-static channel access mode, N2 = 1 in intra-frequency and inter-frequency neighbor cell detection, measurement, and evaluation, i.e., UE considers an SMTC occasion unavailable if the SSB index of the identified cell at the detected SSB position index is not available.
* Recommended WF
  + Companies to provide view on whether to wait for RAN1 or to progress on FBE first.
  + Note that same issue is discussed in **Issue 4-1** and **Issue 5-1**. Consistency is required.

**Issue 1-2: Definition of Ms**

* Current definition of Ms: Ms is the number of DRX cycles with at least one SMTC where there are no SSBs available at the UE during Nserv\_CCA, and Ms< Ms,max.
* Proposals
  + Option 1: (Qualcomm)
    - Ms is the number of DRX cycles with at least one SMTC where SSBs are unavailable at the UE during Nserv (i.e, N2 = 1).
* Recommended WF
  + More discussion is needed

**Issue 1-3: Max number of unavailable SMTC occasions during measurement before UE detects the cell again**

* Background from last meeting WF R4-2005367: For a cell that is already identified, after N unsuccessful measurement attempts due to exceeding the max number of unavailable SMTC occasions, UE needs to detect the cell again. **FFS the value N** and the target cell/carrier to initiate the cell detection procedure
  + Note: the exact behaviour is to be discussed in the next issue
* Proposals
  + Option 1: (Qualcomm)
    - 2
  + Option 2: (Huawei)
    - 4
  + Option 3: (Ericsson)
    - 3
* Recommended WF
  + Need more discussion

**Issue 1-4: UE behaviour when exceeding the max number of unavailable SMTC occasions during measurement to start new**

* Background from last meeting WF R4-2005367: For a cell that is already identified, after N unsuccessful measurement attempts due to exceeding the max number of unavailable SMTC occasions, UE needs to detect the cell again. FFS the value N and **the target cell/carrier to initiate the cell detection procedure**
* Proposals
  + Option 1: (Qualcomm)
    - Do not define the target carrier/cell that UE should initiate detection after reaching N unsuccessful measurement attempts
  + Option 2: (Ericsson, a part of Proposal 4 in R4-2007894)
    - The UE needs to detect the cells on the configured non-serving carriers after reaching N unsuccessful measurement attempts
* Recommended WF
  + Discuss the options.

**Issue 1-5: Whether to initiate the cell selection procedure for the selected PLMN if the UE fails to detect any suitable cell on any of the configured non-serving carriers for 10 s**

* Proposals
  + Option 1: (Ericsson)
    - Yes
* Recommended WF
  + Please comment if Option 1 is agreeable.

**Issue 1-6: Whether to consider LBT failure in Ttarget\_cell\_SMTC\_period in the paging interruption requirements**

* Proposals
  + Option 1: (Ericsson)
    - No
  + Option 2: (Huawei)
    - The paging interruption time shall be extend by unavailable SMTC of target cell as : TSI,CCA + (2+L)\*[Ttarget\_cell\_SMTC\_period], where L is number of the unavailable SMTC of target cell and L≤Lmax, and the value of Lmax is FFS.
    - Upon exceeding Lmax, UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].
* Recommended WF
  + More discussion is needed

## Companies views’ collection for 1st round

### Open issues

**Issue 1-1: Definition of unavailable SMTC/SSB**

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| **Company** | **Comments** |
| ZTE | Support Option 1 which is to wait for RAN1 reply LS (at least till second round). |
| MediaTek | Support Option 1 to wait for RAN1's feedback. |
| Huawei | Support Option 1. |
| Qualcomm | Support option 2. While RAN4 can wait for RAN1 feedback on LBE, it is important to discuss FBE. |
| OPPO | Support Option 1. |
| Ericsson | We support option 1. |
| Apple | Support option 1. |
| Nokia | Support option 1, since we also asked about the differentiation between FBE and LBE in the LS to RAN1. Having said that, our view is that for FBE, N2 – if defined – would always assume the value of 1, since the RAN1 enhancement is not applicable to FBE channel access. |
| Intel | Support Option 1. And the same definition of unavailable SMTC/SSB over all NR-U requirements. |

**Issue 1-2: Definition of Ms**

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| **Company** | **Comments** |
| MediaTek | Support Option 1 to wait for RAN1's feedback. |
| Huawei | Should depend on RAN1’s reply. |
| Qualcomm | Support option 1. During serving cell evaluation, UE needs to accumulate samples and cannot establish presence of lack of SSB based on one sample only. We don’t think this is related to RAN1 feedback. |
| Ericsson | We prefer to wait for RAN1 feedback. |
| Apple | Can wait RAN1 feedback |
| Nokia | Wait for RAN1 feedback. |

**Issue 1-3: Max number of unavailable SMTC occasions during measurement before UE detects the cell again**

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| **Company** | **Comments** |
| ZTE | Can support Option 3, which is 3. |
| Qualcomm | Option 1. Our view is that N>2 leads to very large time scales (more than 10 s) given that each attempt is also extended by allowing some LBT failure. |
| Ericsson | We support option 3. |
| Nokia | We support option 1, for the same reason as QC. |
| Intel | Option 1. |

**Issue 1-4: UE behaviour when exceeding the max number of unavailable SMTC occasions during measurement to start new**

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| **Company** | **Comments** |
| MediaTek | Option 1 is agreeable to us. |
| Huawei | We think is related to UE implementation. Bu the original wording “UE needs to detect the cell again ” is not clear enough to be captured in the spec. We prefer “after N unsuccessful measurement attempts…., the cell shall not be considered as a detected cell” |
| Qualcomm | We support option 1 and share the same concerns as Huawei. |
| Ericsson | We prefer to specify the expected UE behavior instead of leaving it totally up to implementation. Since it might be possible to detect other cells on the same carrier where the UE experienced LBT failure and for that reason failed to measure after N unsuccessful attempts, can following alternative/compromise proposal be agreeable: “UE needs to detect cells on the configured serving- and/or non-serving carriers after reaching N unsuccessful measurement attempts.” ? |
| Apple | Option1, and prefer to leave to UE implementation. |
| Intel | In our view, this is also up to UE implementation .So prefer option 1. |

**Issue 1-5: Whether to initiate the cell selection procedure for the selected PLMN if the UE fails to detect any suitable cell on any of the configured non-serving carriers for 10 s**

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| **Company** | **Comments** |
| MediaTek | Disagree with Option 1, because it may not necessary to initiate cell selection if there are suitable cells on the serving carrier or inter-RAT.  In the exiting requirement, the initiate of cell selection procedure is based on serving carrier (intra-freq.), non-serving carrier (inter-frequency, and inter-RAT, as below:  *“If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].”*  Is it intending to exclude the condition based on serving carrier and inter-RAT and only keep the condition on non-serving carrier? |
| Huawei | The proposal is not aligned with the current wording in the spec. Similar views as MTK, there could be suitable cells on the serving carrier. |
| Qualcomm | We share the same view as MediaTek. |
| Ericsson | Similar to our comments for issue 1-4, since it might be possible to detect other cells on the serving carrier, option 1 can be revised as follows:  “The UE shall initiate the cell selection procedure for the selected PLMN if the UE fails to detect any suitable cell on any of the configured serving or non-serving carriers for 10 s.” |
| Apple | Agree with MTK. |
| Nokia | No. We share the same view as MediaTek. |
| Intel | Same view as MTK. |

**Issue 1-6: Whether to consider LBT failure in Ttarget\_cell\_SMTC\_period in the paging interruption requirements**

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| **Company** | **Comments** |
| MediaTek | Support the 1st bullet in Option 2. But the Lmax and the corresponding UE behavior are not necessary. |
| Huawei | From our understanding, Ttarget\_cell\_SMTC\_periodis for timing tracking to the selected cell. If UE fails to synchronise to the cell, initiating cell selection procedures is the reasonable UE behavior. |
| Qualcomm | We can support option 1. In our understanding, the time scale of **Ttarget\_cell\_SMTC\_period** is significantly smaller than TSI\_CCA . |
| Ericsson | We support option 1. |
| Apple | Do not understand the bullet 2 of option 2. Normally UE shall still keep staying in the original serving cell since it’s not ready to read paging from target cell due to the consistent LBT on T/F tracking occasion of target cell. |
| Nokia | Option 1 |

### CRs/TPs comments collection

Moderator: The baseline CR is recommended according to agreed job partition in [R4-1912663](file:///d:\docs\R4-1912663.zip).

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| **Requirements** | **Comments** | **CR responsibility** | |
| **TS 36.133** | **TS 38.133** |
| Cell reselection | Intra-frequency | **N/A** | **Huawei** |
| Inter-frequency |
| Inter-RAT | **Ericsson** |

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| **CR/TP number** | **Comments collection** |
| [R4-2007696](file:///D:\Docs\R4-2007696.zip)  (HW, 38.133) | Moderator:   * Contain further changes based on endorsed in last meeting. May need to be revised to capture new agreements in this meeting * Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| ZTE: In change 2, should be “The requirements in this section apply regardless of whether the serving cell is subject to CCA or not.” |
| Ericsson: Revision needed to specify the value of N and the associated UE behavior as being discussed. Also the wording needs to be revised to “when subject to CCA is used” as shown in R4-2007978. |
| [R4-2007697](file:///D:\Docs\R4-2007697.zip)  (HW, 38.133) | Moderator: for INACTIVE mode |
| Company B |
| Ericson Similar wording change as in [R4-2007696](file:///D:\Docs\R4-2007696.zip) is needed. |
| [R4-2007895](file:///D:\Docs\R4-2007895.zip) | Moderator: Withdrawn |
| Company B |
|  |
| [R4-2007896](file:///D:\Docs\R4-2007896.zip)  (Ericsson, 36.133) | Moderator: Contain further changes based on endorsed in last meeting. May need to be revised to capture new agreements in this meeting |
| Qualcomm: In this part “For a cell that is already identified, after 3 unsuccessful measurement attempts due to exceeding the max number of unavailable SMTC occasions, UE shall attempt to detect cells on any of the configured intra-frequency, inter-frequency and inter-RAT carriers to detect the cell again..”  The value of 3 is not agreed yet. Also, the UE behavior is not agreed. |
| Nokia: We do not agree with this CR because the discussion is still ongoing. |
| [R4-2007978](file:///D:\Docs\R4-2007978.zip)  (Ericsson, 38.133) | Moderator: Draft CR. Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| Qualcomm: same comments as 7696. |
| Nokia: We do not agree with this CR because the discussion is still ongoing. |

## Summary for 1st round

### Open issues

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

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|  | **Status summary** |
| **Issue 1-1** | **Definition of unavailable SMTC/SSB**  *Status:*   * 8 companies support Option 1 (Wait for RAN1 reply). * 1 company supports Option 2 (Discuss FBE first).   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion. |
| **Issue 1-2** | **Definition of Ms**  *Status:*   * 5 companies suggest to wait for RAN1 feedback * 1 company support Option 1 (N2 = 1)   *Tentative agreements:* No  *Candidate options:*   * Option 1 (same as 1st round) * Option 2: wait for RAN1 feedback   *Recommendations for 2nd round:* Continue discussion. |
| **Issue 1-3** | **Max number of unavailable SMTC occasions during measurement before UE detects the cell again**  *Status:*   * 3 companies support Option 1 (N=2) * 2 companies support Option 3 (N=3)   *Tentative agreements:* No  *Candidate options:*   * Option 1 (N=2) * Option 3 (N=3)   *Recommendations for 2nd round:* Continue discussion. |
| **Issue 1-4** | **UE behaviour when exceeding the max number of unavailable SMTC occasions during measurement to start new**  *Status:*   * 4 [+Huawei] companies support Option 1 (Not to define target carrier/cell) * 1 company supports to define expected UE behavior * 1 company suggest a wording change   *Tentative agreements:* No  *Candidate options:* Same option as 1st round  *Recommendations for 2nd round:* Continue discussion. Companies to also check if Ericsson’s suggest is agreeable “UE needs to detect cells on the configured serving- and/or non-serving carriers after reaching N unsuccessful measurement attempts.” |
| **Issue 1-5** | **Whether to initiate the cell selection procedure for the selected PLMN if the UE fails to detect any suitable cell on any of the configured non-serving carriers for 10 s**  *Status:*   * 6 companies disagree with Option 1 (No) * 1 companies suggests to revise Option 1   *Tentative agreements:* No  *Candidate options:*   * *Revised Option 1:* “The UE shall initiate the cell selection procedure for the selected PLMN if the UE fails to detect any suitable cell on any of the configured serving or non-serving carriers for 10 s.”   *Recommendations for 2nd round:* Continue discussion. Companies to check if the revised Option 1 is agreeable or not. |
| **Issue 1-6** | **Whether to consider LBT failure in Ttarget\_cell\_SMTC\_period in the paging interruption requirements**  *Status:*   * 3 companies support Option 1 * 2 companies are not clear about the bullet 2 of Option 2 * 1 companies support Option 2   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | WF on NR-U RRM Requirements (Part 2) | MediaTek Inc. |

### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [R4-2007696](file:///D:\\Docs\\R4-2007696.zip" \t "_parent) | Revised.  To capture the comments from companies and the conclusions of open issues, if any. |
| [R4-2007697](file:///D:\\Docs\\R4-2007697.zip" \t "_parent) | Revised.  To capture the comments from companies and the conclusions of open issues, if any. |
| [R4-2007895](file:///D:\\Docs\\R4-2007895.zip" \t "_parent) | Withdrawn |
| [R4-2007896](file:///D:\\Docs\\R4-2007896.zip" \t "_parent) | Revised.  To capture the conclusions of open issues, if any. |
| [R4-2007978](file:///D:\\Docs\\R4-2007978.zip" \t "_parent) | Not pursued.  Work on revision of [R4-2007696](file:///D:\\Docs\\R4-2007696.zip" \t "_parent) as the baseline in the 2nd round |

## Discussion on 2nd round (if applicable)

## 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”* |

# Topic #2: Interruptions due to operation in non-NR-U serving cells (AI 6.1.5.8)

Moderator: No paper submitted under this AI.

# Topic #3: Active BWP switching (AI 6.1.5.9)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2006012](file:///D:\Docs\R4-2006012.zip) | ZTE Corporation | 1. Proposal 1: The end point of UL BWP switch is when UE is ready to transmit RACH.   Proposal 2: When performing UL BWP switch, the new BWP shouldn’t contain the old BWP. |
| [R4-2006157](file:///D:\Docs\R4-2006157.zip) | Qualcomm Incorporated | **Observation 1**. All existing procedures that end in RACH transmission (e.g., HO, PSCell addition, RRC re-establishment, RRC connection release with redirection) include the uncertainty in acquiring the first available RACH occasion in their requirements.  **Proposal 1**. The end point of UL BWP switching delay upon detection of UL LBT failure shall be when UE transmits RACH (option 1).  **Observation 2**. Condition relative frequency location of new UL BWP can be deduced from current RAN2 and RAN4 (RF) specifications.  **Proposal 2**. No condition to be added on the relative frequency location of new UL BWP. |
| [R4-2007700](file:///D:\Docs\R4-2007700.zip) | Huawei, Hisilicon | **Proposal 1**: The availability of RACH resource in the delay requirement of BWP switch delay on consistent UL LBT recovery shall not be considered in the core requirements. It could be reflected in the performance part.  **Proposal 2**: If it is agreed to define the restriction on frequency locations of old and new BWPs, RAN2 shall be informed of the conclusion. |
| [R4-2007983](file:///D:\Docs\R4-2007983.zip) | Ericsson | **Availability of PRACH resource:**  **Observation # 1**: The existing requirements already account for the availability of PRACH resource.  **Proposal # 1:** The following clarification can be done to account for the availability of PRACH resource.   * *The UE shall be able to transmit PRACH on the new UL BWP of the SpCell on the first available UL slot occurs right after slot n+TBWPswitchDelay +1, where TBWPswitchDelay is defined in Table 8.6.2-1*   **Non-overlapping condition for the old and new UL BWPs:**  **Observation # 1**: Upon consistent UL LBT failures in the old active UL BWP, the UE should switch to new UL BWP which does not suffer from consistent UL LBT failure.  **Proposal # 2:** The clarification in terms of frequency separation between the old and new UL BWPs is not necessary.  **Proposal # 3:** If needed the existing wording, “..*the UE shall switch the active UL BWP to an UL BWP configured with PRACH occasion and for which consistent LBT failure has not been triggered as defined in TS 38.321 clause 5.21*”, can be clarified to ensure that the UE does not switch to new UL BWP where it experiences also consistent UL LBT failues. |

Moderator: CRs are moved to Section 3.3.2

## Open issues summary

### Active BWP switch triggered by consistent UL LBT failures

**Issue 3-1: The ending point of UL BWP switching delay upon detection of consistent UL LBT failure**

* Proposals
  + Option 1: (ZTE, Huawei)
    - UE is ready to transmit RACH
  + Option 2: (Qualcomm)
    - UE transmits RACH
  + Option 3: (Ericsson)
    - The UE shall be able to transmit PRACH on the new UL BWP of the SpCell on the first available UL slot occurs right after slot n+TBWPswitchDelay +1, where TBWPswitchDelay is defined in Table 8.6.2-1
* Recommended WF
  + Companies to check if Option 3 is agreeable

**Issue 3-2: Whether to introduce any non-overlapping condition for the old and new UL BWPs**

* Proposals
  + Option 1: (ZTE)
    - The new BWP shouldn’t contain the old BWP
  + Option 2: (Qualcomm, Ericsson)
    - No condition to be added on the relative frequency location of new UL BWP
  + Option 3: (Huawei)
    - If it is agreed to define the restriction on frequency locations of old and new BWPs, RAN2 shall be informed of the conclusion
  + Option 4: (Ericsson)
    - UE does not switch to new UL BWP where it experiences also consistent UL LBT failures
* Recommended WF
  + More discussions are needed.

## Companies views’ collection for 1st round

### Open issues

**Issue 3-1: The ending point of UL BWP switching delay upon detection of consistent UL LBT failure**

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| **Company** | **Comments** |
| ZTE | Still prefer Option 1 which is clear enough in our view. |
| MediaTek | Option 1&3 are agreeable to us. |
| Huawei | Option1. We agree that the BWP switch delay could be tested in TC by transmission of RACH. But in the core part, the end point shall be UE is ready to transmit. For HO, RRC reestablishment, the delay is for the whole process which consists cell identification, SI reading. etc. But for BWP switch, the uncertainty of PRACH is not part of BWP switch procedure. |
| Qualcomm | We prefer option 2. If performance spec is supposed to add a budget for RACH compared to core spec, then why not reflect it in the core spec? We cannot agree to option 3 because the first available UL slot occurring right after slot n+TBWPswitchDelay +1 may not even be a RO. |
| Ericsson | Prefer option 3. But option 1 is also agreeable |
| Apple | Option 1 is generally fine. The option 3 needs to consider the RACH occasion uncertainty after the slot n+TBWPswitchDelay +1. Option 2 is not a generic way to define delay requirement (normally use a time uncertainty in the delay requirement instead of using the actual RACH transmission timing point) |
| Nokia | We prefer option 1, which is aligned with the NR Rel 15 text as well. |

**Issue 3-2: Whether to introduce any non-overlapping condition for the old and new UL BWPs**

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| **Company** | **Comments** |
| ZTE | We can agree Option 2 and leave this to UE implementation. |
| MediaTek | OK with Option 2 and up to UE implementation. |
| Qualcomm | Option 2. |
| Ericsson | Option 2 is sufficient |
| Apple | Fine with Option 2 |
| Nokia | Option 2. We understand that this topic was already treated in RAN2, but not agreed. We believe that it should not be discussed in RAN4. Here we copy the text from RAN2 MAC specification:  5> switch the active UL BWP to an UL BWP, on same carrier in this Serving Cell, configured with PRACH occasion and for which consistent LBT failure has not been triggered;  The only condition is that the new UL BWP is configured with PRACH occasion, and the consistent LBT failure has not been triggered. |

### CRs/TPs comments collection

Moderator: The baseline CR is recommended according to agreed job partition in [R4-1912663](file:///d:\docs\R4-1912663.zip).

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| **Requirements** | **Comments** | **CR responsibility** | |
| **TS 36.133** | **TS 38.133** |
| Active BWP switching delay and interruption |  | **N/A** | **Huawei** |
| Interruption |  | **Ericsson** | **Ericsson** |

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| **CR/TP number** | **Comments collection** |
| [R4-2007693](file:///D:\Docs\R4-2007693.zip)  (Huawei, 38.133) | Moderator: Endorsed in last meeting. May need to be revised to capture agreements in **Issue 3-1** and **Issue 3-2**. |
| Ericsson: The CR needs to be revised based on outcome of issues 3-1 and 3-2. There are also editors’ note which need to be removed based on outcome of issues 3-1 and 3-2 |
| Company B |
| [R4-2007984](file:///D:\Docs\R4-2007984.zip)  (Ericsson, 38.133) | Moderator: Endorsed in last meeting |
| Company A |
| Company B |
| [R4-2007985](file:///D:\Docs\R4-2007985.zip)  (Ericsson, 36.133) | Moderator: Endorsed in last meeting |
| Company A |
| Company B |

## Summary for 1st round

### Open issues

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

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|  | **Status summary** |
| **Issue 3-1** | **The ending point of UL BWP switching delay upon detection of consistent UL LBT failure**  *Status:*   * 6 companies support Option 1 (2 companies also fine with Option 3) * 1 company supports Option 2   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion. |
| **Issue 3-2** | **Whether to introduce any non-overlapping condition for the old and new UL BWPs**  *Status:*   * All companies agree with Option 2 (up to UE implementation)   *Tentative agreements:* No condition to be added on the relative frequency location of new UL BWP when UE is performing UL BWP switching upon detection of consistent UL LBT failure.  *Recommendations for 2nd round:* No |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [R4-2007693](file:///D:\\Docs\\R4-2007693.zip" \t "_parent) | Revised.  To capture the conclusions of open issues, if any. |
| [R4-2007984](file:///D:\\Docs\\R4-2007984.zip" \t "_parent) | Agreeable |
| [R4-2007985](file:///D:\\Docs\\R4-2007985.zip" \t "_parent) | Agreeable |

## Discussion on 2nd round (if applicable)

## 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”* |

# Topic #4: RLM and link recovery procedures (AI 6.1.5.10)

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2006014](file:///D:\Docs\R4-2006014.zip) | ZTE Corporation | **Proposal 1**: The OOS evaluation period shall be extended based on unavailable SSBs (Lout). |
| [R4-2006158](file:///D:\Docs\R4-2006158.zip) | Qualcomm Incorporated | **Observation 1**. UE can signal capability to support only semi-static channel access mode, only dynamic channel access mode, or both.  **Observation 2**. In semi-static channel access mode, UE can assume that unavailability of DL due to LBT in a fixed frame period leads to unavailability of all consecutive SSBs within the same fixed frame period.  **Proposal 1**. UE capabilities N1 and N2 to be differentiated in semi-static channel access mode and dynamic channel access mode.  **Proposal 2**. For semi-static channel access mode, N1 = N2 = 1.  **Proposal 3**. Except for initial access, Q factor is always known to UE.  **Proposal 4**. The OOS evaluation period is scaled by a fixed scalar of 1.0.  **Proposal 5**. RAN4 to decide on working on CSI-RS based RLM requirement after receiving LS reply from RAN1. |
| [R4-2006858](file:///D:\Docs\R4-2006858.zip) | MediaTek inc. | **Observation 1**: Extending OOS evaluation period based on Lout is not practical under low SNR condition. The mis-detection rate of SSB presence detection would be >10% when the SNR<-5dB.  **Observation 2**: For Option 2, OOS could be indicated in the SNR higher than Oout, because of mis-detection on SSB.  **Observation 3**: For Option 3, the chance to trigger OOS indication mistakenly can be reduced.  **Proposal 1**: For SSB-based RLM, the OOS evaluation period is scaled by a fixed scaler and the samples whose SNR is higher than X dB will be excluded for OOS evaluation (Option 3).  **Proposal 2**: OOS evaluation period is based on (10 + L) samples, where L is:  • L = 14 for Max(TDRX,TSSB)≤40 where TDRX =0 for non-DRX  • L = 10 for 40<Max(TDRX, TSSB)≤320  • L = 6 for TDRX >320 |
| [R4-2007264](file:///D:\Docs\R4-2007264.zip) | Nokia, Nokia Shanghai Bell | 1. The SINR in unlicensed spectrum is likely to be higher than in licensed spectrum, however, it is not possible to guarantee that this will always be the case. 2. There is no consensus in whether the UE can distinguish missing RLM-RS (due to LBT failure) from RLM-RS received with low SINR, therefore it cannot be assumed in the RAN4 requirements. 3. Extend the SSB based RLM OOS evaluation period by a fixed factor. 4. Define the SSB based RLM OOS evaluation period based on a fixed extension as follows:   L = 14 for max(TSSB, TDRX) ≤ 40,  L = 10 for 40 <Max(TDRX, TSSB)≤320  L = 6 for TDRX >320   1. The mechanism introduced by RAN1, herein referred to as “beam cycling”, is only useful for LBE networks. 2. RAN4 to define different requirements for FBE and LBE mode. 3. N1 is not defined for FBE mode. In FBE mode, as the UE may monitor only the first Q candidate SS/PBCH block indexes of the discovery burst transmission window in any case for which the UE is aware of the timing of the corresponding cell. 4. The spectrum load is not under the gNB control. It depends on the number of nodes that are competing for the channel access, and on the traffic load. 5. In low spectrum load scenarios, it is not expected for the gNB to configure a long DRS transmission window, since it would be wasting resources without any real benefit to the network. 6. In high spectrum load scenarios, RAN1 design allows for longer DRS transmission windows. If UEs are not monitoring these candidate positions, there is no gain in the RAN1 design. 7. For LBE, for an LBT success probability of 20% and Q=1 a probability above 90% that the SSB is within a monitoring window is only achieved with at least 11 candidate positions. 8. The previous observation considers a simplified LBT model with uncorrelated probability of LBT success for each candidate position. In real deployments, it is expected that the probability of LBT failure is correlated between neighbour candidate positions. E.g. the duration of a transmission in 5GHz spectrum can be up to 10 ms [11]. 9. RAN4 to wait for RAN1 feedback for the discussion of N1 values for LBE mode. 10. Adopt the same approach for CSI-RS based RLM as in SSB based RLM, and define the in-sync evaluation period as:  |  |  | | --- | --- | | **Configuration** | **TEvaluate\_in\_CSI-RS (ms)** | | no DRX | Max(100, Ceil((Min­+Lin-CSI-RS)×P) × TCSI-RS) | | DRX ≤ 320ms | Max(100, Ceil(1.5×(Min­+Lin-CSI-RS)×P)× Max(TDRX, TCSI-RS)) | | DRX > 320ms | Ceil((Min­+Lin-CSI-RS)×P) × TDRX | | NOTE 1: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10ms, 20 ms or 40 ms. TDRX is the DRX cycle length.  NOTE 2: Lin-CSI-RS is the number of CSI-RS not available at the UE during **TEvaluate\_in\_CSI-RS**, and Lin-CSI-RS < Lin-CSI-RS\_max  NOTE 3: Lin-CSI-RS\_max = TBD for max(TDRX, TCSI-RS)≤ 40, where TDRX = 0 for non-DRX, Lin-CSI-RS\_max = TBD for 40<max(TDRX, TCSI-RS)≤ 320 and Lin-CSI-RS\_max = TDB for TDRX > 320. | |  1. Adopt the same approach for CSI-RS based RLM as the proposed for SSB based RLM, and define the extension of the out-of-sync evaluation period based on a fixed number of samples as follows:  |  |  | | --- | --- | | **Configuration** | **TEvaluate\_out\_CSI-RS (ms)** | | no DRX | Max(200, Ceil((Mout­+Lout-CSI-RS)×P) × TCSI-RS) | | DRX ≤ 320ms | Max(200, Ceil(1.5×(Mout­+Lout-CSI-RS)×P)× Max(TDRX, TCSI-RS)) | | DRX > 320ms | Ceil((Mout­+Lout-CSI-RS)×P) × TDRX | | NOTE 1: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10ms, 20 ms or 40 ms. TDRX is the DRX cycle length.  NOTE 2: Lout-CSI-RS = TBD for max(TDRX, TCSI-RS)≤ 40, where TDRX = 0 for non-DRX, Lout-CSI-RS= TBD for 40<max(TDRX, TCSI-RS)≤ 320 and Lout-CSI-RS= TDB for TDRX > 320. | | |
| [R4-2007341](file:///D:\Docs\R4-2007341.zip) | OPPO | **Proposal 1**: The UE is expected to be able to detect a SSB at any candidate SSB position where the gNB may transmit a SSB.  **Observation 1**: There is no need to define N1 and N2, and UE should be capable of monitoring all the candidate SSB positions that are QCL’ed.  **Proposal 2**: The UE should be allowed to stop detecting the remaining candidate SSB positions after it detects at least one SSB for the same SSB index within a given discovery burst transmission window.  **Proposal 3**: No requirement for the case Q is not provided to UE.  **Proposal 4**: FBE and LBE should be treated in a same manner.  **Proposal 5**: The evaluation period for OOS is scaled by a fixed scaling factor excluding samples whose SNR is higher than [-3] dB.  **Proposal 6**: CSI-RS based RLM requirement as low priority in Rel-16. |
| [R4-2007387](file:///D:\Docs\R4-2007387.zip) | Ericsson | **Proposal 1:** Set the SSB based BFD evaluation period for NR-U by reusing RLM in-sync. The evaluation table is specified as follows:   |  |  | | --- | --- | | **Configuration** | **TEvaluate\_BFD\_SSB (ms)** | | no DRX | max(50, ceil((5+LBFD)\*P)\*TSSB) | | DRX cycle ≤ 320ms | max(50, ceil(1.5\*(5+LBFD)\*P)\*max(TDRX,TSSB)) | | DRX cycle > 320ms | ceil((5+LBFD)\*P)\*TDRX | | Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: LBFD is the number of SSBs not available at the UE during TEvaluate\_BFD\_SSB where LBFD ≤ LBFD\_max.  Note 3: LBFD\_max=7 for Max(TDRX, TSSB) ≤ 40ms where TDRX=0 for no DRX, LBFD\_max=5 for 40ms < Max(TDRX, TSSB) ≤ 320ms, and LBFD\_max =3 for TDRX > 320ms. | |   **Proposal 2:** If LBFD > LBFD,max, UE behavior is the same as if the radio link quality is below Qout\_LR, i.e., the beam failure instance indication to the higher layers.  **Proposal 3:** For CSI-RS based BFD, RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1.  **Proposal 4:** If RAN1 agree with the mechanism of CSI-RS validation, set the CSI-RS based BFD evaluation period considering LBT failure as follows:   |  |  | | --- | --- | | **Configuration** | **TEvaluate\_BFD\_CSI-RS (ms)** | | no DRX | max(50, ceil((MBFD+LBFD)\*P)\*TCSI-RS) | | DRX cycle ≤ 320ms | max(50, ceil(1.5\*(MBFD+LBFD)\*P)\*max(TDRX,TCSI-RS)) | | DRX cycle > 320ms | ceil((MBFD+LBFD)\*P)\*TDRX | | Note 1: TCSI-RS is the periodicity of CSI-RS in the set . TDRX is the DRX cycle length.  Note 2: LBFD is the number of CSI-RSs not available at the UE during TEvaluate\_BFD\_CSI-RS where LBFD ≤ LBFD\_max.  Note 3: LBFD\_max=Ceil([1.4] x MBFD) for Max(TDRX, TCSI-RS) ≤ 40ms where TDRX=0 for no DRX, LBFD\_max=MBFD for 40ms < Max(TDRX, TCSI-RS) ≤ 320ms, and LBFD\_max =Ceil([0.6] x MBFD) for TDRX > 320ms. | |   MBFD is the number of CSI-RSs and set MBFD=10 if the CSI-RS resource(s) in set  used for BFD is transmitted with Density = 3.  **Proposal 5:** Set the SSB based CBD evaluation period for NR-U as follows:   |  |  | | --- | --- | | **Configuration** | **TEvaluate\_CBD\_CBD (ms)** | | non-DRX, DRX cycle ≤ 320ms | Max(25, ceil((3+LCBD)\*P) \* TSSB) | | DRX cycle > 320ms | ceil((3+LCBD) \*P) \* TDRX | | Note 1: TDRS is the periodicity of DRS in the set . TDRX is the DRX cycle length.  Note 2: LCBD is the number of SSBs not available at the UE during TEvaluate\_CBD\_SSB where LCBD ≤ LCBD\_max.  Note 3: LCBD,max=7 for Max(TDRX,TSSB) ≤ 40ms where TDRX=0 for non-DRX, LCBD\_max=5 for 40ms < Max(TDRX, TSSB) ≤ 320ms, and LCBD\_max=3 for TDRX > 320ms. | |   **Proposal 6:** If LCBD > LCBD,max, UE behavior is same as the case UE cannot find any candidates.  **Proposal 7:** For CSI-RS based CBD, RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1.  **Proposal 8:** If RAN1 agree with the mechanism of CSI-RS validation, set the CSI-RS based CBD evaluation period considering LBT failure as follows:   |  |  | | --- | --- | | **Configuration** | **TEvaluate\_CBD\_CSI-RS (ms)** | | no DRX, DRX cycle ≤ 320ms | max(25, ceil((MCBD+LCBD)\*P)\*TCSI-RS) | | DRX cycle > 320ms | ceil((MCBD+LCBD)\*P)\*TDRX | | Note 1: TCSI-RS is the periodicity of CSI-RS in the set  . TDRX is the DRX cycle length.  Note 2: LCBD is the number of CSI-RSs not available at the UE during TEvaluate\_CBD\_CSI-RS where LCBD ≤ LCBD\_max.  Note 3: LCBD\_max= MCBD for Max(TDRX, TCSI-RS) ≤ 40ms where TDRX=0 for no DRX, LCBD\_max=Ceil([1.6] x MCBD) for 40ms < Max(TDRX, TCSI-RS) ≤ 320ms, and LCBD\_max =Ceil([2.3] x MCBD) for TDRX > 320ms. | |   MCBD is the number of CSI-RSs and set MBFD=3 if the CSI-RS resource(s) in set  used for CBD is transmitted with Density = 3. |
| [R4-2007703](file:///D:\Docs\R4-2007703.zip) | Huawei, Hisilicon | **Observation 1:**  Potential ways to define N1/N2:  Option1: Introduce a new capability signalling to indicate the supported N1 and N2  Option 2: Define N1/N2 as constant number in TS 38.133  **Proposal 1:** RAN4 shall confirm the assumption that UE is not able to distinguish the unavailable RLM-RS in low SNR in NR-U.  **Proposal 2:** The OOS evaluation period is extended as: (NExpected-navailable)\*M+ navailable, where NExpected is the expected number of samples, which could be same as that in licensed band; navailable is the number of available samples (SNR>X dB) within the evaluation period; M is a fixed scaler.  **Proposal 3:** The requirement for both CSI-RS and SSB abased RLM/BFD/CBD shall be defined in Rel-16.  **Proposal 4:** The changes suggested in LS from RAN1 is needed, and it shall be applied to both R15 and R16 spec for consistency. |
| [R4-2007970](file:///D:\Docs\R4-2007970.zip) | Ericsson | SSB-based RLM:  **Proposal 1**: RLM out-of-sync requirements are specified based on Option 2, i.e., evaluation period depends on Lout (Lout ≤ Lout,max), where Lout is the number of SSBs not available at the UE during TEvaluate\_out\_SSB  **Proposal 2**: Detection based on multiple samples could be assumed at low SINRs (e.g., Es/Iot<-6 dB), to facilitate the UE ability to determine the presence of SSBs.  **Proposal 3**: Lout,max values are as follows:   * + Lout,max = 14 for Max(TDRX,TSSB)≤40 where TDRX=0 for non-DRX   + Lout,max = 10 for 40<Max(TDRX,TSSB)≤320   + Lout,max = 6 for TDRX>320   **Proposal 4**: Upon exceeding Lout,max for one RLM-RS resource the UE behaviour is the same as if the radio link quality for this RLM-RS resource were below Qout.  CSI-RS based RLM:  **Proposal 5**: For CSI-RS based RLM in-sync, adopt the approach based on Lout, where Lout ≤Lout,max is the number of SSBs not available at the UE, i.e., what has been already agreed for SSB-based RLM in-sync.  **Proposal 6**: The evaluation period for CSI-RS based RLM in-sync is specified as shown in the table below:   |  |  | | --- | --- | | **Configuration** | **TEvaluate\_in\_CSI-RS (ms)** | | no DRX | Max(100, Ceil((10+Lin,CSI-RS)×P) × TCSI-RS) | | DRX ≤ 320ms | Max(100, Ceil(1.5×(10+Lin,CSI-RS)×P)× Max(TDRX, TCSI-RS)) | | DRX > 320ms | Ceil((10+Lin,CSI-RS)×P) × TDRX | | NOTE 1: TCSI-RS is the periodicity of the CSI-RS configured for RLM. TDRX is the DRX cycle length.  NOTE 2: Lin,CSI-RS is the number of CSI-RS resources not available at the UE during TEvaluate\_in\_CSI-RS, where Lin,CSI-RS≤ Lin,CSI-RS,max.  NOTE 3: Lin,CSI-RS,max = TBD for Max(TDRX,TCSI-RS)≤40 where TDRX=0 for non-DRX,  Lin,CSI-RS,max = TBD for 40<Max(TDRX,TCSI-RS)≤320,  Lin,CSI-RS,max = TBD for TDRX>320 | |   **Proposal 7**: The Lin,CSI-RS,max values are as follows:   * + Lin,CSI-RS,max = [14] for Max(TDRX,TCSI-RS)≤40 where TDRX =0 for non-DRX   + Lin,CSI-RS,max = [10] for 40<Max(TDRX,TCSI TCSI RS)≤320   + Lin,CSI-RS,max = [6] for TDRX >320   **Proposal 8**: UE behaviour when Lin,CSI-RS,max is exceeded: the same as for SSB-based RLM in-sync.  **Proposal 9**: For CSI-RS based RLM out-of-sync, adopt the approach based on Lout, where Lout ≤Lout,max is the number of SSBs not available at the UE. |

Moderator: CRs are moved to Section 4.3.2

## Open issues summary

### SSB-based RLM

**Issue 4-1: The set of SSBs that UE is required to monitor**

* Background:
  + In last meeting, RAN4 agreed to introduce UE capability. An LS was sent to ask RAN1 to decide the numbers
* Proposals
  + Option 1: (Qualcomm)
    - UE capabilities N1 (and N2) to be differentiated in semi-static channel access mode and dynamic channel access mode.
    - For semi-static channel access mode, N1 (= N2) = 1.
  + Option 2: (Nokia)
    - N1 is not defined for FBE mode. RAN4 to wait for RAN1 feedback for N1 values for LBE mode
  + Option 3: (OPPO)
    - The UE is expected to be able to detect a SSB at any candidate SSB position where the gNB may transmit a SSB. FBE and LBE should be treated in a same manner.
* Recommended WF
  + Companies to provide view on whether to wait for RAN1 or to progress on FBE first.
  + Note that same issue is discussed in **Issue 1-1** and **Issue 5-1**. Consistency is required.

**Issue 4-2: Whether UE is able to distinguish the unavailable RLM-RS in low SNR in NR-U**

* Proposals
  + Option 1: (Huawei)
    - UE is not able to distinguish the unavailable RLM-RS in low SNR in NR-U
  + Option 2: (Ericsson)
    - If needed, detection based on multiple samples could be assumed at low SINRs (e.g., Es/Iot<-6 dB), to facilitate the UE ability to determine the presence of SSBs
* Recommended WF
  + Need more discussion.

**Issue 4-3: SSB-based OOS evaluation period**

* Background: 2 options in agreed WF R4-2005367 in last meeting
  + Option 2: OOS evaluation is based on Lout, where Lout ≤Lout,max is the number of SSBs not available at the UE during TEvaluate\_out\_SSB
  + Option 3: The evaluation period is scaled by a fixed scaler
    - FFS: excluding samples whose SNR is higher than X dB
* Proposals
  + Option 1a: (Qualcomm)
    - The OOS evaluation period is scaled by a fixed scalar of 1.0.
  + Option 1b (Nokia)
    - Extend the SSB based RLM OOS evaluation period by a fixed factor.
    - Define the SSB based RLM OOS evaluation period based on a fixed extension as follows:
      * L = 14 for max(TSSB, TDRX) ≤ 40,
      * L = 10 for 40 <Max(TDRX, TSSB)≤320
      * L = 6 for TDRX >320
  + Option 2: (Ericsson, [ZTE])
    - Evaluation period depends on Lout (Lout ≤ Lout,max), where Lout is the number of SSBs not available at the UE during TEvaluate\_out\_SSB
      * Lout,max = 14 for Max(TDRX,TSSB)≤40 where TDRX=0 for non-DRX
      * Lout,max = 10 for 40<Max(TDRX,TSSB)≤320
      * Lout,max = 6 for TDRX>320
    - Upon exceeding Lout,max for one RLM-RS resource the UE behaviour is the same as if the radio link quality for this RLM-RS resource were below Qout.
  + Option 3a: (MediaTek)
    - The OOS evaluation period is scaled by a fixed scaler and the samples whose SNR is higher than X dB will be excluded for OOS evaluation
    - OOS evaluation period is based on (10 + L) samples, where L is:
      * L = 14 for Max(TDRX,TSSB)≤40 where TDRX =0 for non-DRX
      * L = 10 for 40<Max(TDRX, TSSB)≤320
      * L = 6 for TDRX >320
  + Option 3b: (OPPO)
    - The evaluation period for OOS is scaled by a fixed scaling factor excluding samples whose SNR is higher than [-3] dB
  + Option 3c: (Huawei)
    - The OOS evaluation period is extended as: (NExpected-navailable)\*M+ navailable, where NExpected is the expected number of samples, which could be same as that in licensed band; navailable is the number of available samples (SNR>X dB) within the evaluation period; M is a fixed scaler.
* Recommended WF
  + Need more discussion

**Issue 4-4: Availability of Q factor**

* Proposals
  + Option 1: (Qualcomm)
    - Except for initial access, Q factor is always known to UE.
  + Option 2: (OPPO)
    - No requirement for the case Q is not provided to UE.
* Recommended WF
  + Companies to check if Options 1 and 2 can be merged, e.g., For SSB-based RLM, Q factor is always known to UE. Otherwise, requirement does not apply.

### CSI-RS based RLM

**Issue 4-5-1: Whether and when to start discuss CSI-RS based RLM requirement**

* Proposals
  + Option 1: (Qualcomm)
    - RAN4 to decide on working on CSI-RS based RLM requirement after receiving LS (R4-2005377) reply from RAN1.
  + Option 2a: (Huawei, Ericsson, Nokia)
    - The requirement for both CSI-RS and SSB abased RLM/BFD/CBD shall be defined in Rel-16.
  + Option 3: (OPPO)
    - CSI-RS based RLM requirement as low priority in Rel-16
* Recommended WF
  + Need more discussion

**Issue 4-5-2: Evaluation period for CSI-RS RLM in-sync**

* Proposals
  + Option 1 (Ericsson, Nokia, Nokia Shanghai Bell): Same as the already agreed approach for SSB-based RLM in-sync (i.e., based on Lin, where Lin ≤Lin,max)
* Recommended WF
  + Discuss the proposals

**Issue 4-5-3: Evaluation period for CSI-RS RLM out-of-sync**

* Proposals
  + Option 1 (Ericsson): based on Lin, where Lin ≤Lin,max
  + Option 2 (Nokia):

Adapt the same approach for extending evaluation period for CSI-RS based RLM as the proposed for SSB based RLM, e.g., fixed scaling or depending on LBT.TBD the values

* Recommended WF
  + Discuss the proposals

### BFD requirements

**Issue 4-6: SSB based BFD requirement**

* Proposals
  + Option 1: (Ericsson)
    - Set the SSB based BFD evaluation period for NR-U by reusing RLM in-sync. The evaluation table is specified as follows:

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_SSB (ms)** |
| no DRX | max(50, ceil((5+LBFD)\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(50, ceil(1.5\*(5+LBFD)\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil((5+LBFD)\*P)\*TDRX |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: LBFD is the number of SSBs not available at the UE during TEvaluate\_BFD\_SSB where LBFD ≤ LBFD\_max.  Note 3: LBFD\_max=7 for Max(TDRX, TSSB) ≤ 40ms where TDRX=0 for no DRX, LBFD\_max=5 for 40ms < Max(TDRX, TSSB) ≤ 320ms, and LBFD\_max =3 for TDRX > 320ms. | |

* + - If LBFD > LBFD,max, UE behavior is the same as if the radio link quality is below Qout\_LR, i.e., the beam failure instance indication to the higher layers.
* Recommended WF
  + Companies to provide comment on Option 1

**Issue 4-7: CSI-RS based BFD requirement**

* Proposals
  + Option 1: (Ericsson)
    - RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1.
* Recommended WF
  + Companies to provide comment on Option 1

### CBD requirements

**Issue 4-8: SSB based CBD requirement**

* Proposals
  + Option 1: (Ericsson)
    - Set the SSB based CBD evaluation period for NR-U as follows:

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_CBD (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, ceil((3+LCBD)\*P) \* TSSB) |
| DRX cycle > 320ms | ceil((3+LCBD) \*P) \* TDRX |
| Note 1: TDRS is the periodicity of DRS in the set . TDRX is the DRX cycle length.  Note 2: LCBD is the number of SSBs not available at the UE during TEvaluate\_CBD\_SSB where LCBD ≤ LCBD\_max.  Note 3: LCBD,max=7 for Max(TDRX,TSSB) ≤ 40ms where TDRX=0 for non-DRX, LCBD\_max=5 for 40ms < Max(TDRX, TSSB) ≤ 320ms, and LCBD\_max=3 for TDRX > 320ms. | |

* + - If LCBD > LCBD,max, UE behavior is same as the case UE cannot find any candidates.
* Recommended WF
  + Is Option 1 agreeable?

**Issue 4-9: CSI-RS based CBD requirement**

* Proposals
  + Option 1: (Ericsson)
    - RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1.
* Recommended WF
  + Companies to provide comment on Option 1

## Companies views’ collection for 1st round

### Open issues

**Issue 4-1: The set of SSBs that UE is required to monitor**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Wait for RAN1 reply LS. |
| MediaTek | Wait for RAN1 reply LS. |
| Huawei | Wait for RAN1 reply LS. |
| Qualcomm | Option 1 (I believe Option 2 is also the same). For FBE, the same requirements as in LBE cannot be applied (unless RAN4 agrees that FBE requirements are applicable to both FBE and LBE). Option 3 is not agreeable to all. |
| OPPO | Support option 3. The UE is expected to be able to detect a SSB at any candidate SSB position where the gNB may transmit a SSB. FBE and LBE should be treated in a same manner.  And also agree to wait for RAN1 reply LS. |
| Ericsson | Wait for RAN1 response LS |
| Apple | Wait for RAN1 reply LS. |
| Nokia | Wait for RAN1 reply. |
| Intel | Wait for RAN1 reply LS |

**Issue 4-2: Whether UE is able to distinguish the unavailable RLM-RS in low SNR in NR-U**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | We support Option 2. Actually we think that we can assume that the UE is able to distinguish the two mentioned situations while the algorithms are left to UE implementation. |
| MediaTek | Support Option 1.  Regarding Option 2, the multiple samples cannot be used to determine the presence of SSBs when the SSB samples are not at the same position. |
| Huawei | Option 1. RAN4 shall first make the decision on this issue before proceeding the discussion on the details of requirements. |
| Qualcomm | We support option 1. Option 2 disregards implementation complexity and practical considerations. Moreover, even if UE uses multiple samples, what happens if all used samples go through LBT failure? How is UE supposed to distinguish this from all samples going through poor channel? |
| OPPO | We think what level “low SNR” is should be clarified before decision on this issue.  Option 2 could be helpful in side condition for UE to distinguish the unavailable RLM-RS. |
| Ericsson | Option 2 has been supported also in LTE LAA, but the details can be left to UE implementation. We do not think that multiple samples are strictly necessary but we could accept this as a compromise for UE.  Furthermore, the core of the issue is not at low SINRs where the UE will end up with RLF, regardless of whether the signal is present and weak or is not present. The main problem is when the signal is actually good but there are LBT failures and in this SINR range the UE is very well able to distinguish when the signal is present so the approach based on Lmax is very well suited and feasible here. |
| Apple | Support option 1. If UE cannot know actual SSB transmission position of each occasion how can UE perform the combining to have gain? and also as Qualcomm commented, how UE distinguish between “all the SSBs experienced LBT failure” and “all the SSBs experienced poor channel” |
| Nokia | This issue has been discussed for many meetings and it is blocking the finalization of the requirements. To understand Ericsson’s comment: should we have two sets of requirements depending on the SINR? In high SINR, we assume that the UE can determine the presence of SSBs, so the approach based on Lmax, and in low SINRs, what is the assumption, is it to use multiple samples? What about Qualcomm’s and Apple’s comments? |
| Intel | We support Option1. From UE implementation itself, the option 2 will increase higher complexity but without the higher confidence on the detection on deep fading or LBT failure.  We also share same view as Huawei. This assumption is quite critical to decide OOS evaluation time requirements, which need to be set with higher priority. |

**Issue 4-3: SSB-based OOS evaluation period**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Support Option 2. Consistent with our view for issue 4-2, we think that the UE can be assumed to have such capability, while the actual algorithm used is left to UE implementation. |
| MediaTek | OK with Option 1 or Option 3. Option 3 would be a good possible compromise.  On Option 2, assuming UE is always able to distinguish the presence of SSB is not practical. |
| Huawei | We support option 3c. Actually option 3b and 3c is same. For option 1, where is to mitigate the impact of LBT by adjusting the N310, NW will frequent reconfigure N310 since it is the only way for extension. For option 2, as we have explained for several meetings, UE cannot make reliable determination in low SNR. Compared to the option 1b and 3a (fixed extension), option 3b/c is a good compromise to handle the concerns from proponent of option 2 (unbalance between OOS and INS) |
| Qualcomm | We support option 1a. Compared to option 1b, our view is that the scaling factor should by default be 1.0 because the default should be no significant load/LBT failure rather than worst case load and LBT failure. We cannot agree to option 3 because it creates complexities for practical implementations. The evaluation in R15 can be done in a “sliding-window” fashion, i.e., one indicator is based on 10 samples, the next indicator is based on the current 9 samples plus one more new sample, and so on.   * + In this way, calculating the extension will be tricky, especially for M > 1.   + It will be more like “recursive”, i.e., when the evaluation period is extended, there could be new missing samples, and the N\_expected is supposed to increase w/ longer period, and so on. |
| OPPO | Support option 3 along with SNR>-3 dB |
| Ericsson | Option 2, at least for SINR>=TBD (e.g., -8 dB). For very low SINR we may allow the UE to either use multiple samples (see issue 4-2) or count them all in a pre-defined way (e.g. one of: as weak signals or as not present signal).  As clarified under issue 4-2: the core of the issue is not at low SINRs where the UE will end up with RLF, regardless of whether the signal is present and weak or is not present. The main problem is when the signal is actually good but there are LBT failures and in this SINR range the UE is very well able to distinguish when the signal is present so the approach based on Lmax is very well suited and feasible here. |
| Apple | Support option 1a and 1b. We are also fine if the scalar is greater than 1, e.g. 1.5 in option 1a as a compromise. |
| Nokia | We prefer option 1, the exact values could be further discussed. |
| Intel | We support Option 3a |

**Issue 4-4: Availability of Q factor**

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| --- | --- |
| **Company** | **Comments** |
| ZTE | Support Option 1. Not sure if the two options can be merged since in our view, Q can always be assumed to be known to the UE, so scenarios described in Option 2 might not exist (or only exist as corner cases). |
| MediaTek | Support Option 1, and Option 1 and Option 2 can be merged.  According to the current TS 38.331, Q is mandatory except for initial access. |
| Huawei | Support the recommended WF. |
| Qualcomm | Agree with WF |
| OPPO | Support the recommended WF, and Options 1 and 2 can be merged. |
| Ericsson | Recommended WF looks Ok |
| Apple | Fine with recommended WF. |
| Nokia | The text that is agreeable to us is: For SSB-based RLM, Q factor is always known to UE . In this issue, we are just discussing the availability of Q factor during RLM and link recovery procedures, right? We don’t see the possibility of merging options 1 and 2, since, in this context, Q factor is always provided to the UE. Agreeing on the second part of the WF “Otherwise, requirement does not apply” would imply that in some cases of SSB-based RLM, Q is not known at the UE, and this is not true. |
| Intel | Support the recommended WF |

**Issue 4-5: Whether and when to start discuss CSI-RS based RLM requirement**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | 4-5-1: Support Option 2a which is to define CSI-RS based measurement requirements in R16.  4-5-2: Option 1.  4-5-3: Support Option 1. |
| MediaTek | 4-5-1: Prefer to Option 3 and disagree with Option 2a. RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1.  4-5-2: Same comment as 4-5-1. RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1.  4-5-3: Same comment as 4-5-1. |
| Huawei | 4-5-1: We are fine to wait for the LS reply from RAN1. Both SSB-based and CSI-based RLM are facing some general issues, both shall defined if we get concrete conclusions from RAN1.  4-5-2: We can wait for the LS reply first.  4-5-3: We can wait for the LS reply first. |
| Qualcomm | Issue 4-5-1: We support option 1 and option 3. We cannot agree to anything based on CSI-RS until we receive feedback from RAN1.  Issue 4-5-2: Wait for LS reply first. Even for INS.  Issue 4-5-3: Wait for LS reply first. |
| OPPO | 4-5-1: Support option 3. Similar views as MTK.  4-5-2: Depend on issue 4-5-1.  4-5-3: Depend on issue 4-5-1. |
| Ericsson | 4-5-1: Support option 2a. Option 1 (LS in R4-2005377) is only misleading and has nothing to do with the need for the requirements. Actually, RAN1 specification already says that the CSI-RS power is not independently set but based on SSB power, and we are defining SSB-based requirements… Furthermore, we can clarify the requirements applicability condition, if necessary, or refer to other specifications to resolve the concern; or to progress we can make RAN4 assumption and further discuss the requirements, while the assumption is being confirmed.  4-5-2: option 1. Do not understand the need to wait for the response LS (see also the comment on 4-5-1).  4-5-3: option 1 |
| Apple | Issue 4-5-1: Support option 1 and option 3.  Issue 4-5-2: Hold on until LS reply from RAN1.  Issue 4-5-3: Hold on until LS reply from RAN1. |
| Nokia | 4-5-1: Option 2a, but we are also ok in waiting for the feedback from RAN1.  4-5-2: We support Option 1, but are also fine in waiting for the feedback from RAN1.  4-5-3: We support Option 2, but are also fine in waiting for the feedback from RAN1. |
| Intel | 4-5-1: wait for RAN1 LS reply. From RAN4, we prefer to deprioritize CSI-RS works in Rel16.  4-5-2: Depend on issue 4-5-1.  4-5-3: Depend on issue 4-5-1. |

**Issue 4-6: SSB based BFD requirement**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | It should be based on the conclusion of RLM OOS. We cannot agree on the table now. |
| Qualcomm | We share the same view as MediaTek. |
| Ericsson | Option 1. Since the side condition of BFR is SNR>-3dB, it is pessimistic to reuse RLM OOS whose side condition. |
| Apple | Same views as MTK and QC. |
| Nokia | We should agree on RLM OOS first. |
| Intel | We share the same view as MediaTek. Up to the conclusion of RLM OOS |

**Issue 4-7: CSI-RS based BFD requirement**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Support Option 1. RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1. |
| Huawei | Option 1. |
| Qualcomm | Option 1. |
| OPPO | Support option 1. |
| Ericsson | Option 1 |
| Apple | Option 1 |
| Nokia | Option 1. |
| Intel | Option 1 |

**Issue 4-8: SSB based CBD requirement**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | It should be based on the conclusion of RLM INS. We cannot agree on the table now. |
| Qualcomm | Support option 1. |
| Ericsson | Support option 1. Since CBD is based on L1-RSRP measurement, we should not reuse RLM. |
| Apple | Agree with MTK. |
| Nokia | We support option 1. To our understanding the RLM INS was already concluded some meetings ago, wasn’t it? |
| Intel | Support Option 1. The evaluation time for RLM Ins was agreed in R4#92b. |

**Issue 4-9: CSI-RS based CBD requirement**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Support Option 1. RAN4 should wait for the conclusion of CSI-RS validation discussed in RAN1. |
| Huawei | Option 1. |
| Qualcomm | Option 1. |
| OPPO | Support option 1. |
| Ericsson | Option 1 |
| Apple | Option 1 |
| Nokia | Option 1. |
| Intel | Option 1. |

### CRs/TPs comments collection

Moderator: The baseline CR is recommended according to agreed job partition in [R4-1912663](file:///d:\docs\R4-1912663.zip).

|  |  |  |  |
| --- | --- | --- | --- |
| **Requirements** | **Comments** | **CR responsibility** | |
| **TS 36.133** | **TS 38.133** |
| RLM |  | **N/A** | **Ericsson** |

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [R4-2007263](file:///D:\Docs\R4-2007263.zip)  (Nokia, RLM) | Moderator: Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| Ericsson: The CR overlaps with the discussion under maintenance |
| Company B |
| [R4-2007388](file:///D:\Docs\R4-2007388.zip)  (Ericsson, LR) | Company A |
| Company B |
| Qualcomm: Why are the hypothetical parameters in the table all TBD. Do we expect them to be different than R15?  The requirements for link recovery procedure in the clause apply when CCA is used on a serving or neighbouring frequency on the downlink.  Suggest to remove “neighboring frequency”  Ericsson: Hypothetical parameters have not been discussed yet, but possibly they will be the same as in Rel-15 in the end. That is why they are TBD in this meeting.  Nokia: This CR contains topics that were not agreed yet (BFD, CDB), so it is not agreeable to us. We suggest to use **TEvaluate\_BFD\_SSB\_CCA** instead of**TEvaluate\_BFD\_SSB** to be consistent to what has been agreed in other parts of the spec. |
| [R4-2007698](file:///D:\Docs\R4-2007698.zip)  (Huawei, RLN, R15) | Moderator: Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| Qualcomm: We don’t think this clarification is necessary in R15 since the confusion with the word “candidate” can only happen in R16. |
| Ericsson: The CR is not needed. Change #2 needs further discussion, together with a general applicability issue. Change #1 is being discussed under maintenance. |
| Nokia: Same as Qualcomm and Ericsson. Furthermore, we think that the second change is misplaced. We do not agree with the second change for Rel-15. |
| [R4-2007699](file:///D:\Docs\R4-2007699.zip)  (Huawei, RLN, R16) | Moderator: Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| Ericsson: see comments on the Rel-15 CR |
| Nokia: We think that the second change is misplaced, since it is related to Clause 5. We cannot agree to this CR, and it is not included in the summary of change. |
| [R4-2007971](file:///D:\Docs\R4-2007971.zip)  (Ericsson, RLM) | Moderator: Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| Qualcomm: Why are hypothetical parameters TBD? Do we expect them to be different than R15?  Ericsson: Hypothetical parameters have not been discussed yet, but possibly they will be the same as in Rel-15 in the end. That is why they are TBD in this meeting.  Nokia: This CR is not agreeable to us, it contains topics that were not agreed yet, for example, T\_evaluate\_out for SSB-based RLM. |
| Company B |

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 4-1** | **The set of SSBs that UE is required to monitor**  *Status:*   * 8 companies suggest to wait for RAN1 LS reply * 1 company support Option 1 and Option 2 (N1=N2=1 or undefined for FBE) * 1 companies support Option 3 (UE to detect any candidate position)   *Tentative agreements:* No  *Candidate options:*   * Option 1: (same as 1st round) * Option 2: (same as 1st round) * Option 3: (same as 1st round) * Option 4: wait for RAN1 LS reply   *Recommendations for 2nd round:* Continue discussion. |
| **Issue 4-2** | **Whether UE is able to distinguish the unavailable RLM-RS in low SNR in NR-U**  *Status:*   * 5 companies support Option 1 (UE cannot) * 2 companies support Option 2 (UE can) * 1 company suggest to clarify the SNR side condition   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion. There are 2 sub issues that may need to be clarified first.   * The level of low SNR is not clear (mentioned by OPPO) * What happens if all used samples go through LBT failure (mentioned by Qualcomm) |
| **Issue 4-3** | **SSB-based OOS evaluation period**  *Status:*   * 4 companies support Option 1a or 1b * 3 companies support Option 3a, 3b or 3c * 2 companies support Option 2   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion. It seems that Issue 4-2 should be concluded first. |
| **Issue 4-4** | **Availability of Q factor**  *Status:*   * All companies support Option 1 (Q is always known to UE) * 7 companies agree to merge Option and Option 2   *Tentative agreements:* Except for initial access, Q factor is always known to UE. |
| **Issue 4-5-1** | **Whether and when to start discuss CSI-RS based RLM requirement**  *Status:*   * 7 companies are fine to wait for RAN1 conclusion * 4 companies support Option 3 (de-prioritize in Rel-16) * 3 companies supports 2a (define requirement in Rel-16)   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion. |
| **Issue 4-5-2** | **Evaluation period for CSI-RS RLM in-sync**  *Status:*   * 7 companies suggest to wait for the RAN1 conclusion * 3 companies support Option 1 (follow SSB INS approach)   *Tentative agreements:* No  *Candidate options:*   * Option 1: (same as 1st round) * Option 2: RAN4 to wait for the RAN1 conclusion   *Recommendations for 2nd round:* Continue discussion. |
| **Issue 4-5-3** | **Evaluation period for CSI-RS RLM out-of-sync**  *Status:*   * 7 companies support to wait for the RAN1 conclusion * 2 companies support Option 1 (dynamic evaluation period) * 1 company support Option 2 (fixed evaluation period)   *Tentative agreements:* No  *Candidate options:*   * Option 1: (same as 1st round) * Option 2: (same as 1st round) * Option 3: wait for the RAN1 conclusion   *Recommendations for 2nd round:* Continue discussion |
| **Issue 4-6** | **SSB based BFD requirement**  *Status:*   * 5 companies suggest to conclude on SSB based RLM OOS first * 1 company support Option 1   *Tentative agreements: No*  *Candidate options:*   * Option 1: (same as 1st round) * Option 2: RAN4 to conclude on SSB based RLM OOS first   *Recommendations for 2nd round:* Continue discussion |
| **Issue 4-7** | **CSI-RS based BFD requirement**  *Status:* All companies support Option 1 (wait for the conclusion of CSI-RS validation discussed in RAN1)  *Tentative agreements:* RAN4 start to discuss CSI-RS based BFD requirement after RAN1 conclude on CSI-RS validation. |
| **Issue 4-8** | **SSB based CBD requirement**  *Status:*   * 4 companies support Option 1 * 2 companies suggest to wait for RLM INS conclusion   *Tentative agreements:* No  *Recommendations for 2nd round:* Please MTK and Apple to check the comments from other companies and comment if it is OK to go with Option 1. |
| **Issue 4-9** | **CSI-RS based CBD requirement**  *Status:* All companies support Option 1 (wait for the conclusion of CSI-RS validation discussed in RAN1)  *Tentative agreements:* RAN4 start to discuss CSI-RS based BFD requirement after RAN1 conclude on CSI-RS validation. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [R4-2007263](file:///D:\\Docs\\R4-2007263.zip" \t "_parent) | Not pursued  Same issue is covered by CR R4-2007963 and R4-2007664 in Email thread 201. |
| [R4-2007388](file:///D:\\Docs\\R4-2007388.zip" \t "_parent) | Revised  To capture companies comments and the conclusion of open issues, if any |
| [R4-2007698](file:///D:\\Docs\\R4-2007698.zip" \t "_parent) | Not pursued   * Change #1 is covered by CR R4-2007963 and R4-2007664 in Email thread 201. * Change #2 is not in the **Reason for change*.*** Moderator assumes this is some legacy text when sharing the same template among multiple CRs. |
| [R4-2007699](file:///D:\\Docs\\R4-2007699.zip" \t "_parent) | Not pursued   * Change #1 is covered by CR R4-2007963 and R4-2007664 in Email thread 201.   Change #2 is not in the **Reason for change*.*** Moderator assumes this is some legacy text when sharing the same template among multiple CRs. |
| [R4-2007971](file:///D:\\Docs\\R4-2007971.zip" \t "_parent) | Revised  To capture companies comments and the conclusion of open issues, if any |

## Discussion on 2nd round (if applicable)

## 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*

|  |  |
| --- | --- |
| **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”* |

# Topic #5: Timing (AI 6.1.5.13)

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2006013](file:///D:\Docs\R4-2006013.zip) | ZTE Corporation | **Proposal 1:** At least one SSB shall be available at UE during last 160 ms.  **Proposal 2:** If the current timing reference cell is unavailable at the UE for more than 160 ms then the UE is allowed to use any of available activated SCell(s) at the UE in STAG as a new reference cell. |
| [R4-2006162](file:///D:\Docs\R4-2006162.zip) | Qualcomm Incorporated | **Proposal 1**. The value of N is at least one. Whether it needs to be greater than one depends on the reply LS from RAN1 and cannot be discussed before then.  **Proposal 2.** If a reference cell on a carrier frequency belonging to the PTAG/STAG, which is subject to CCA, is unavailable at the UE for more than 160 ms then the UE is allowed to use any of available activated SCell(s) at the UE in PTAG/STAG as a new reference cell. |
| [R4-2006862](file:///D:\Docs\R4-2006862.zip) | MediaTek inc. | **Proposal 1:** If a reference cell is unavailable, UE should be allowed to use any of available activated SCell as a new reference cell, provided that the UE meets all the transmit timing requirements defined in section 7.1.2. |
| [R4-2007094](file:///D:\Docs\R4-2007094.zip) | Ericsson | * If a reference cell on a carrier frequency belonging to the PTAG, which is subject to CCA, is unavailable at the UE for more than 160 ms then the UE [is allowed or shall] use any of available activated SCell(s) at the UE in PTAG as a new reference cell. * If a reference cell on a carrier frequency belonging to the STAG, which is subject to CCA is unavailable at the UE for more than 160 ms then the UE [is allowed or shall] use any of available activated SCell(s) at the UE in STAG as a new reference cell. |

Moderator: CRs are moved to Section 5.3.2

## Open issues summary

### UL Tx timing requirement

**Issue 5-1: Definition of “reference cell is available”**

* Proposals
  + Option 1: (ZTE, ~~[Qualcomm] ,~~ Ericsson)
    - At least one SSB shall be available at UE during last 160 ms
  + Option 2: (Qualcomm)
    - RAN4 to discuss this after RAN1 replies the LS R4-2005418
* Recommended WF
  + Note that same issue is discussed in **Issue 1-1** and **Issue 4-1**. Consistency is required.

**Issue 5-2: If a reference cell on a carrier frequency belonging to the PTAG/STAG, which is subject to CCA, is unavailable at the UE for more than 160 ms then the UE [is allowed to or shall] use any of available activated SCell(s) at the UE in PTAG/STAG as a new reference cell**

* Proposals
  + Option 1: (ZTE, Qualcomm, MediaTek)
    - ‘is allowed’
  + Option 2: (Ericsson)
    - ‘shall’
* Recommended WF
  + TBD

## Companies views’ collection for 1st round

### Open issues

**Issue 5-1: Definition of “reference cell is available”**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Can wait for RAN1 reply LS till end of the first round. |
| MediaTek | Support Option 2. To wait for RAN1’s feedback. |
| Huawei | Option 2. |
| Qualcomm | Option 2 |
| Ericsson | Option 1 |
| Apple | Option 2 |
| Nokia | We prefer option 1, but it is also Ok to wait for RAN1 feedback. |

**Issue 5-2: If a reference cell on a carrier frequency belonging to the PTAG/STAG, which is subject to CCA, is unavailable at the UE for more than 160 ms then the UE [is allowed or shall] to use any of available activated SCell(s) at the UE in PTAG/STAG as a new reference cell**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | To us this is an issue which could be left to UE implementations. |
| MediaTek | Support Option 1, “is allowed”, which is up to UE implementations. |
| Huawei | Option 1. “is allowed” |
| Qualcomm | Option 1. There is no need for “shall”. It has no material difference to NW. |
| Ericsson | We support option 2. If we would choose option 1, then the network will not know whether an allocated resource is used by the UE or not. This means that, the UE will see performance degradations. Also, the network will not be able to do efficient scheduling due to this being left to UE implementation. This will make the performance of NR-U inferior compared to WiFi and other systems, since NR-U will loose in performance. Thus, we prefer to have it as “shall”, that is option 2. |
| Apple | Option 1 |

### CRs/TPs comments collection

Moderator: The baseline CR is recommended according to agreed job partition in [R4-1912663](file:///d:\docs\R4-1912663.zip).

|  |  |  |  |
| --- | --- | --- | --- |
| **Requirements** | **Comments** | **CR responsibility** | |
| **TS 36.133** | **TS 38.133** |
| UE timing related requirements | MRTD | **N/A** | **MTK** |
| UE transmit timing | **N/A** | **MTK** |
| MTTD | **N/A** | **MTK** |
| TA | **N/A** | **MTK** |
| UE timer accuracy (UE-specific, not cell-specific requirement) | **N/A** | **MTK** |

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [R4-2006863](file:///D:\Docs\R4-2006863.zip)  (MediaTek) | Moderator: Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| Ericsson: We prefer to have “shall” instead of “is allowed” as described in above section and as shown in our CR in R4-2007097. |
| Company B |
| [R4-2007097](file:///D:\Docs\R4-2007097.zip)  (Ericsson) | Moderator: Collect comments on all CRs. The company responsible for the final CR will provide the final CR, based on the collected comments. |
| Nokia: this CR depends on issues being discussed. It is not agreeable to us. |
| Company B |

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 5-1** | **Definition of “reference cell is available”**  *Status:*   * + 6 companies are fine to wait for RAN1 feedback   + 2 companies supports Option 1 (At least 1 SSB available at UE during last 160 ms)   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion. |
| **Issue 5-2** | **If a reference cell on a carrier frequency belonging to the PTAG/STAG, which is subject to CCA, is unavailable at the UE for more than 160 ms then the UE [is allowed to or shall] use any of available activated SCell(s) at the UE in PTAG/STAG as a new reference cell**  *Status:*   * + 5 companies support Option 1 (is allowed)   + 1 company support Option 2 (shall)   *Tentative agreements:* No  *Candidate options:* Same as 1st round  *Recommendations for 2nd round:* Continue discussion |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [R4-2006863](file:///D:\\Docs\\R4-2006863.zip" \t "_parent) | Revised  To capture the conclusion of open issue if any. |
| [R4-2007097](file:///D:\\Docs\\R4-2007097.zip" \t "_parent) | Not pursued  To work on the revision of [R4-2006863](file:///D:\\Docs\\R4-2006863.zip" \t "_parent) in the 2nd round |

## Discussion on 2nd round (if applicable)

## 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*

|  |  |
| --- | --- |
| **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”* |