3GPP TSG-RAN WG2 #119bis-e Tdoc R2-xxxxxxx

Electronic meeting, 10th - 19th Oct. 2022

Agenda Item: 8.13.4

Source: Ericsson (Rapporteur of the offline)

Title: [AT119bis-e][803][R18 SON/MDT] SON of NR-U (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This document is for the following offline discussion focusing on the proposal 3-8 of the summary document R2-2210799.

 **[AT119bis-e][803][R18 SON/MDT] SON of NR-U (Ericsson)**

Discussion on the proposals 3-8 in R2-2210799.

Intended outcome: Report

Deadline: 04:44 UTC, Friday October 14th

Deadline for comments: 18:00 UTC Thursday October 13th

# 2 Contact list

Contact person for each participating company:

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Ali Parichehreh | Ali.Parichehreh@ericsson.com |
| Samsung | Aby K Abraham | Aby.abraham@samsung.com |
| Xiaomi | xiaowei jiang | jiangxiaowei@xiaomi.com |
| Huawei, HiSilicon | Jun Chen | jun.chen@huawei.com |
| CATT | Jie Shi | shijie@catt.cn |
| CMCC | Aitong Han | [hanaitong@chinamobile.com](mailto:hanaitong@chinamobile.com) |
| Lenovo | Le Yan | yanle1@lenovo.com |
| NEC | Wangda | wangda@labs.nec.cn |
| Nokia | Malgorzata Tomala | malgorzata.tomala@nokia.com |
| ZTE | Zhihong Qiu | qiu.zhihong@zte.com.cn |
| Apple | Sasha Sirotkin | ssirotkin@apple.com |
| Qualcomm | Rajeev Kumar | rkum@qti.qualcomm.com |

# 3 Discussion for enhancing RA Report for NR-U

In this section, we focus on the proposals and summary of the proposals for the NRU related measurements and information to be collected as part of RA report.

Please note that proposals are reshuffled for the offline discussion from the ones which are easy to be agreed to the ones that require more discussion.

Based on the contributions, 6 companies including Lenovo, ZTE, Samsung, CATT, Ericsson and CMCC in [1, 3, 5, 7, 10] proposed to introduce an indication of consistent LBT failure in the RA report. 4 companies proposed to have the consistent LBT failure indication as a new *raPurpose*. Provided that the rapporteur proposes the following:

Proposal 7: Introduce a new *raPurpose* in the *RA-Report* to indicate that the RA was initiated following a “consistent LBT failures” in the SpCell.

* **Q1: Do you agree to introduce a new *raPurpose,* indicating “consistent LBT failure”, as proposed in Proposal 7?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | Yes |  |
| Xiaomi | Yes |  |
| Huawei, HiSilicon | No | We see that some new parameters are likely to be introduced in RA report and they are related to “consistent LBT failure”, so “consistent LBT failures” type can be implicitly indicated. |
| CATT | Yes | We think it is necessary to introduce a new *raPurpose* to convey which event triggers the RACH procedure. |
| Ericson | Yes | Concerning Huawei comment: we think even if the UE experience LBT and log LBT information in RA report, such information do not reflect whether the consistent LBT issue was the reason for triggering the RA procedure.  What is logged in the RA report, is what occurs during RA procedure while the raPurpose is what occurred right before the RA procedure |
| CMCC | Yes |  |
| Lenovo | Yes |  |
| NEC | Yes |  |
| Nokia | No | Given RAN3 LS and request to include ‘indications of consistent LBT failures’, we share Huawei view, that this is likely some indication will be there. Though, it might be too premature to agree the new purpose for RA procedure. It might appear that some other indicator on LBT failure can serve the purpose too, resulting in redundancy. |
| ZTE | Yes |  |
| Apple | Yes |  |
| Qualcomm | No | Similar view as Huawei and Nokia. We can further evaluate the requirement for explicit ra-purpose. |

Rapporteur´s summary: To be added later

In addition, Xiaomi proposed that the value 0 should be introduced for the number of preambles sent over selected SSB and CSI-RS. Although this is provided by a single company, rapporteur thinks this is a valid and easily agreeable proposal, hence proposing the following.

**Proposal 8: RAN2 to introduce value 0 for the numberOfPreamblesSentOnSSB and numberOfPreamblesSentOnCSI-RS.**

* **Q2: Do you agree to Proposal 8?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | Yes |  |
| Xiaomi | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes |  |
| Ericsson | Yes |  |
| CMCC | Yes |  |
| Lenovo | Yes |  |
| NEC | Yes |  |
| Nokia | Not sure | It requires impact to ASN.1, thus we wonder if this is practical case to consider that no preambles were sent |
| ZTE | Needs clarification | Please note in Q3 majority agrees that an RA attempt is when UE transmits preamble, and existing RA report structure is UE includes information per RA attempt. Therefore the scenario is now confusing to us. Suggest to check in stage 3 after we figure out the information requires for NR-U. |
| Apple | Not sure | OK to discuss this further |
| Qualcomm | May be | I believe, we can follow the current definition of the numberOfPreamblesSentOnSSB and numberOfPreamblesSentOnCSI-RS, where these IEs only count the number of actual preamble transmission, i.e., number of times preamble transmission was not blocked by LBT failures. In rel-18, we can make this an optional IE or start with zero both are okay. |

Rapporteur´s summary: To be added later

Xiaomi in [6] proposed to clarify the definition of the RA attempt. The reasoning is that RA procedure tailored for the NR-U, works slightly different from legacy RA procedure and *PREAMBLE\_TRANSMISSION\_COUNTER* does not increase when UE experience LBT failure (and is configured with the LBT recovery) upon transmitting the preamble. This is shown in the following excerpt from TS 38.331.

1> if LBT failure indication is received from lower layers for this Random Access Preamble transmission:

2> if *lbt-FailureRecoveryConfig* is configured:

3> perform the Random Access Resource selection procedure (see clause 5.1.2).

2> else:

3> increment *PREAMBLE\_TRANSMISSION\_COUNTER* by 1;

In fact, instead of *PREAMBLE\_TRANSMISSION\_COUNTER* UE counts the number of LBT failures experienced along with the attempt to transmit the preambles and concludes the failure of RA procedure upon reaching the maximum number of LBT failure instances configured by the network.

Therefore, rapporteur proposes the following:

**Proposal 6-a: RAN2 clarify that in NR-U:**

1. **An RA attempt is an attempt to transmit a preamble as UE executes section 5.1.3 of TS 38.321**

**or**

1. **An RA attempt is only counted when the PREAMBLE\_TRANSMISSION\_COUNTER increased (i.e., when UE accesses the channel at the PHY layer, and transmits the preamble).**

Based on the above proposal rapporteur would like to ask companies the following question.

* **Q3: Which one of the options proposed in Proposal 6-a is acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | a/b | Comments |
| Samsung | b |  |
| Xiaomi | b | Since preamble transmission with LBT failure will not be counted for PREAMBLE\_TRANSMISSION\_COUNTER, and the list size of RA attempt is equal to the maximum preamble transmission, if we record every preamble transmission with LBT failure, the records of RA attempts will easily reach the maximum value, and easily make UE buffer full. |
| CATT | b |  |
| Ericsson | b |  |
| CMCC | b |  |
| Lenovo | b |  |
| NEC | b |  |
| Nokia | a | We think the Proposal isn’t correct. ‘RA attempt’ in terms of Random Access procedure is equivalent with Random Access Preamble transmission attempt.  We believe the intention isn’t to change generic terms or meaning of RA procedure for NR-U, and such direction shouldn’t be driven by SON/MDT feature.  If we agree the NR-U specific RA attempt is bind to the counter increase, does it mean that e.g. the first successful RA attempt (with no counter increase) isn’t RA attempt? |
| ZTE | See comments | Based on existing behavior, b is only valid when lbt-FailureRecoveryConfig is configured, in case it is absent, UE will increase the counter even LBT indication is received from lower layer. Thus both can be true. A can cover also b while it is impossible to do the other way around. But inthe other hand, to adopt a might have impact on existing RA report structure. Suggest to postpone to have more time to investigate the details. |
| Apple | b |  |
| Qualcomm | A | In my understanding what B state is incorrect, i.e., PREAMBLE\_TRANSMISSION\_COUNTER is increased even if LBT failure is indicated to the MAC from lower layer.  In my understanding, an RA attempt is an attempt to transmit a preamble irrespective of whether LBT failure is detected or not. |

Rapporteur´s summary: To be added later

In addition, Samsung and Ericsson in [3 and 8] proposed to include the LBT indication per RA attempt, while Huawei in [4] and CMCC in [7] proposed to include the number of LBT failures and Lenovo [5] proposed to include the time duration of the LBT issue in the RA report. Rapporteur judges that a middle-ground solution between camp (a) and (b) can be the number of LBT failures per selected reference signal e.g., number of LBT failures per SSB. Needless to mention that this solution would be beneficial for the network to configure the SSB beams for the UEs based on the LBT issues.

Therefore, the rapporteur of the offline discussion proposes the following:

**Proposal 6-b: RAN2 discuss which of the following measurement and information to be added to the RA-InformationCommon**

1. **Whether each RA attempt (i.e., preamble transmission) was blocked by LBT,**
2. **Total number of LBT failures during an RA procedure,**
3. **Number of LBT failures per selected beam,**
4. **Time duration of the LBT failures during the RA procedure.**

Based on the above proposal rapporteur would like to ask companies the following question.

* **Q4: Which options proposed in Proposal 6-b is acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | a/b/c/d | Comments |
| Samsung | b | We think that b) provides sufficient granularity. |
| Xiaomi | b | In WI NR above 52.6GHz, directional LBT was discussed, but RAN2 at last do not introduce directional LBT, consistent LBT failure still based on omni-direction. Thus, there is no need to count LBT failure per SSB. |
| Huawei, HiSilicon | b | For a), it may bring significant overhead. For any impacts to the field PerRAAttemptInfo-r16, we should be careful as there are some iterations inside the RA report, e.g.  RA-InformationCommon-r16 ::= SEQUENCE {  perRAInfoList-r16 PerRAInfoList-r16,  }  PerRAInfoList-r16 ::= SEQUENCE (SIZE (1..200)) OF PerRAInfo-r16  PerRAInfo-r16 ::= CHOICE {  perRASSBInfoList-r16 PerRASSBInfo-r16,  perRACSI-RSInfoList-r16 PerRACSI-RSInfo-r16  }  PerRASSBInfo-r16 ::= SEQUENCE {  ssb-Index-r16 SSB-Index,  numberOfPreamblesSentOnSSB-r16 INTEGER (1..200),  perRAAttemptInfoList-r16 PerRAAttemptInfoList-r16  }  PerRAAttemptInfoList-r16 ::= SEQUENCE (SIZE (1..200)) OF PerRAAttemptInfo-r16  PerRAAttemptInfo-r16 ::= SEQUENCE {  contentionDetected-r16 BOOLEAN OPTIONAL,  dlRSRPAboveThreshold-r16 BOOLEAN OPTIONAL,  ...,  [[  fallbackToFourStepRA-r17 ENUMERATED {true} OPTIONAL  ]]  }  For c) and d), we are not clear about the value from network point of view. |
| CATT | b) | a. We think option a) only includes Preamble transmission which is not sufficient.  c. It is a bit of complex and we are wondering how to use the beam information since LBT is performed per BWP.  d. we are wondering how to do the statistic on the time duration of the LBT failures during the RA procedure since LBT is performed for each UL transmission. |
| Ericsson | c | We think just knowing the total number of LBT failure limits the possible optimizations. A finer granularity can be helpful to analyze the RA reports properly and optimize the RA resources.  For example, by logging the number of LBT failures per SSB beam, network can figure out the following information   * How many times the UE successfully transmitted the preambles for the selected beam * How many times UE failed in accessing the channel for the selected beam   This enables the network to understand how much the selected beam was good (interesting bea for the UE) and then distinguish the uplink-downlink coverage mismatch (per SSB beam) from LBT issues.  For example, as shown in the table below, if UE succeeded one time on transmission on SSB1, and 20 times UE experienced LBT failure when trying on SSB1, It would be a better SSB beam compared to the SSB2 that UE succeeded 2 timer to transmit the preamble and UE didn’t failed with LBT issue at all. It can be deduced that once the LBT issue is fixed, the UE succeeded on SSB1, which means SSB1 is a better resource to be configured for UEs e.g., for HO or BFR, etc.   |  |  |  | | --- | --- | --- | | SSB number | Number of preamble transmission | Number of LBT failures per selected SSB | | SSB1 | 1 | 20 | | SSB2 | 2 | 0 | | SSB1 | 1 | 0 | |
| CMCC | b | We think this granularity is enough, but if the finer granularity is required, a or c can be further discussed. |
| Lenovo | a, b, d | For d, time duration for UL LBT per RA procedure is useful for RACH optimization analysis, for example, if too long time duration is spent for UL LBT, it may mean that the failure is mainly caused by channel occupancy rather than unsuitable RACH configuration or radio link quality. |
| NEC | b |  |
| Nokia | a | B could be acceptable if the failure number is above certain number |
| ZTE | a,c | It is beneficial ton know if an RA attempt has been blocked by LBT, and on which beams UE experience most LBTs, which might be beneficial for NW to configure dedicated RA resource.Depends on how c is included perhaps a might be implicitly indicated. |
| Apple | b |  |
| Qualcomm | B | NR-U is a very dynamic system. Achieving the optimizations in such system is very difficult. Therefore, instead of wasting UE resource, RAN2 should focus on relevant information.  For example, instead of indicating per attempt, UE indicated how many attempts were blocked or not blocked by LBT failure indication. To reduce the overhead instead of indicating per SSB/CSI-RS, we can reduce the total number of failures. |

Rapporteur´s summary: To be added later

Companies (including Huawei, Ericsson [4, 8]) proposed to include the RSSI and EDT in the RA report. Huawei proposed to log the RSSI in the RA-InformationCommon and Ericsson proposed to include the RSSI measurements per RA attempt. Rapporture believes the granularity of the RSSI measurements value can be discussed as FFS, when companies agreed to include the RSSI measurements in the RA-InformationCommon.

**Proposal 3: UE logs RSSI measurement and the applied EDT value in the RA-InformationCommon. FFS on logging granularity.**

Based on the above proposal rapporteur would like to ask companies the following question.

* **Q5: Do you agree with Proposal 3?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | Yes |  |
| Xiaomi | Yes |  |
| Huawei, HiSilicon | Yes | We are open to discuss the logging level/granularity, and the signalling overhead should be checked. |
| CATT | Yes for RSSI | We think RSSI can be included in the RA-InformationCommon. But we are wondering whether EDT value is included in RA-InformationCommon since EDT value is set to be less or equal to the maximum EDT threshold which is configured by the network or set by the UE based on some rules. This value is more about optimization of LBT configuration. And even this value is reported to NW, how the NW uses this value is still unclear. |
| Ericsson | Yes |  |
| CMCC | Yes |  |
| NEC | Yes |  |
| Nokia | No | We would see it is useful to understand the usefulness of the metric inclusion from RAN2 pov. |
| ZTE | No, can include RSSI in RLF-report as requested by RAN3 | I wonder if this is relevant to RACH configuration optimization? We shall includes RSSI on RLF-report as agreed by RAN3. |
| Apple | yes |  |
| Qualcomm | No | In rel-16/rel-17 UE indicates/reports radio-related measurements to determine   * Why a particular method of random access is selected for the RACH procedure (for example, 2-step vs 4-step), or * Why a particular beam is selected for random access   In our understanding, the LBT behaviour is determined by the EDT instead of RSSI. In practice implementation, UE may use the maximum value of EDT to optimize its transmission opportunity, therefore reporting EDT will increase the RA report size without having any actual benefits. Therefore, both RSSI and EDT reporting is not required. |

Rapporteur´s summary: To be added later

In addition, BWP specific lbt-FailureRecoveryConfig is proposed to be logged in the RA report and in particular in the RA-InformationCommon. However, it is proposed in [2] to consult RAN3 whether it is possible and evaluate the cost for the network nodes to know this information without UE reporting. Therefor rapporteur of the offline discussion proposed the following:

**Proposal 5: RAN2 to**

1. **Include BWP specific lbt-FailureRecoveryConfig in the RA report, or**
2. **Consult RAN3 to whether it is possible and evaluate the cost for the network to know the lbt-FailureRecoveryConfig without UE reporting.**

Based on the above proposal rapporteur would like to ask companies the following question.

* **Q6: Which of the options (a/b) in Proposal 5 is acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | a/b | Comments |
| Samsung | Consult RAN3 |  |
| Xiaomi | b | We should understand whether there is need to report the whole lbt-FailureRecoveryConfig, perhaps in some scenario, network only needs to know whether lbt-FailureRecoveryConfig is configured or not. |
| Huawei, HiSilicon | b |  |
| CATT | b | We think we can consult RAN3 for decision. |
| Ericsson | b |  |
| CMCC | a | As the lbt-FailureRecoveryConfig is configured dedicated per UE, and similar per UE configuration IE *choConfig*, was discussed in r17 and consulted RAN3. RAN3 replied this relies on network implementation. The network may not store this kind of per UE configuration. Besides, lbt-FailureRecoveryConfig contains only two elements which we think will not cause too much overhead if included it in RA report.  If companies have strong preference to consult RAN3, we are also ok. |
| Lenovo | b |  |
| NEC | b |  |
| Nokia | b | Support to investigate what are the NW possibilities before agreeing to any config repetition by the UE |
| ZTE | a | Same view as CMCC that the configuration is dedicated configured, it would be extra burden for NW to memory the configuration for all UEs, it is preferred to let UE reports. But we can go with majority to check with RAN3. |
| Apple | b |  |
| Qualcomm | B | In our understanding, this should be available to the network Therefore, instead of increasing the size of the UE report unnecessarily, should be handled on the network side. |

Rapporteur´s summary: To be added later

# Conclusion

To be added later.

# References

1. [R2-2209573](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2209573.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2209573)[NR-U enhancements for SON](file:///C:\R2-2209573.zip) **CATT**
2. [R2-2209765](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2209765.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2209765)[SON enhancements for NR-U](file:///C:\R2-2209765.zip) **Apple**
3. [R2-2209824](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2209824.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2209824)[SON/MDT enhancements for NR-U](file:///C:\R2-2209824.zip) **Samsung R&D Institute India**
4. [R2-2209897](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2209897.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2209897)[Discussion on SON for NR-U](file:///C:\R2-2209897.zip) **Huawei, HiSilicon**
5. [R2-2209958](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2209958.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2209958)[Discussion on MRO for NR-U](file:///C:\R2-2209958.zip) **Lenovo**
6. [R2-2210039](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2210039.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2210039)[Discussion on SON for NR-U](file:///C:\R2-2210039.zip) **Xiaomi**
7. [R2-2210148](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2210148.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2210148)[SONMDT enhancement for NR-U](file:///C:\R2-2210148.zip) **CMCC**
8. [R2-2210180](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2210180.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2210180)[Enhancements of SON reports for NR-U](file:///C:\R2-2210180.zip) **Ericsson**
9. [R2-2210270](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2210270.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2210270)[MRO and MDT enhancements for NR-U](file:///C:\R2-2210270.zip) **Nokia, Nokia Shanghai Bell**
10. [R2-2210290](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119bis-e/Docs/R2-2210290.zip)[M](http://mannerheim.nomadiclab.com/Mannerheim/tdoc/R2-2210290)[Consideration on NR-U related SON](file:///C:\R2-2210290.zip) **ZTE Corporation, Sanechips**