3GPP TSG-RAN WG2 #113e Tdoc R2-20xxxxx

Electronic meeting, Jan 25th – Feb 5th, 2021

Agenda Item: 9.1.2

Source: Ericsson

Title: Summary of Email Discussion [AT113-e][304][NBIOT/eMTC R17] Neighbour cell measurements before RLF

Document for: Discussion, Decision

# 1 Introduction

* [AT113-e][304][NBIOT/eMTC R17] Neighbour cell measurements before RLF (Ericsson)

 **Scope:**

 Week 1: 1) What to ask in RAN4 LS. 2) Options for how to do measurements and trigger condition.

 Week 2: 2) Approved LS 2) TBD online Monday 1 Feb

 **Intended outcome:**

 Week 1: Report in R2-2102154

 Week 2: Approved LS in R2-2102156

 **Deadline:**

 Week 1: Jan 29 1100 UTC

 Week 2: Feb 04 1100 UTC

The objective is to formulate an LS to RAN4 with questions that can help RAN4 to define Neighbor cell measurements to be performed in RRC Connected mode. For this purpose, a draft LS has also been provided.

# 2 How to do Measurements

In this section, companies are requested to provide their view on how UE may perform measurements.

Some assumptions have been provided in [[R2-2101157](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2101157.zip)] and [R2-2100325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100325.zip) regarding the measurements; companies are requested to provide their view.

Question 1:

For NB-IoT, Can RAN2 assume any of the below?

* intra- and inter-frequency neighbor cell requirements defined for RRC\_IDLE can be applied in RRC\_CONNECTED state.
* The neighbor cell measurements performed by the UE in connected mode are intra-frequency measurements when anchor carrier of the current cell and anchor carrier of the neighbor cell operates on the same carrier frequency.
* The neighbor cell measurements performed by the UE in connected mode are inter-frequency measurements when anchor carrier of the neighbor cell operates on a different carrier frequency, compared to anchor carrier of the current cell.

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| Company | Yes/No | Comments |
| Ericsson  | No | This will be discussed anyway by RAN4. We should not spend time on this. |
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In [R2-2100324](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100324.zip) understanding, for the static or low mobility NB-IoT UE, the channel quality changes slowly, the measurement results can be thought as valid if not a long time has passed. In this way, for NB-IoT, it can be assumed a neighbor cell is known if it has been measured by the UE and not a long time has passed or the channel quality hardly changes.

Question 2:

For NB-IoT, can RAN2 agree whether a neighbor cell can be thought as known if it has been measured by the UE and not a long time has passed, or the channel quality hardly changes.

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| Company | Yes/No | Comments |
| Ericsson  | No | This will be discussed by RAN4. We should not spend time on this. |
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Question 3:

[R2-2100324](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100324.zip) provides analysis that in order to try to reduce the impacts of measurement on data transmission in connected mode, the interval between the available measurement occasions may also need to be considered and the value may be at least 20ms. Does RAN2 agree?

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| Company | Yes/No | Comments |
| Ericsson  | No | This will be discussed by RAN4. We should not spend time on this. |
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Question 4:

[R2-2100324](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100324.zip) provides analysis that in order to try to reduce the impacts of measurement on data transmission in connected mode, the interval between the available measurement occasions may also need to be considered and the value may be at least 20ms. Does RAN2 agree?

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| Company | Yes/No | Comments |
| Ericsson  | No | This will be discussed by RAN4. We should not spend time on this. |
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[[R2-2101157](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2101157.zip)] provide details that NB-IoT UE may require gaps in order to perform the measurement.

Question 5:

Does RAN2 agree with the observation that

*UE may need to retune its receiver whenever it performs measurements on a neighbour cell with different centre frequency than the centre frequency of the downlink dedicated channels hence cause interruptions to data transfer.*

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| Company | Yes/No | Comments |
| Ericsson  | No | This will be discussed by RAN4. We should not spend time on this. |
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## 3 Trigger Condition

[R2-2101113](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113-e/Docs/R2-2101113.zip), [R2-2100670](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113-e/Docs/R2-2100670.zip) discusses the need of trigger condition.

Considering, the neighbor cell measurement to take place before RLF is beneficial to reduce the time taken to RRC reestablishment to another cell as in WID, the following options could be further discussed to trigger the neighbour cell measurement before the RLF procedure to assist the cell selection procedure to find suitable frequency or cell.

* Option1, the neighbour cell measurement could be trigger when the serving cell channel quality is lower than a threshold.
* Option2, the neighbour cell measurement could be trigger based on the RLM procdure. For example, after n number of consecutive "out-of-sync" indications for PCell is detected.
* Option 3: combination of option1 and option2; multiple triggers (e.g., a configured threshold of RSRP/RSRQ, T310) are applied, the neighbour cell measurement would be triggered whichever the configured threshold of RSRP/RSRQ is met or T310 starts.

Companies are invited to provide their view on which trigger condition is preferred.

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| Company | Option | Comments |
| Ericsson | 2 | We think Option 2 is optimum so that UE starts the neighbor cell measurement when it is really needed to be done. As such T310 is configured long in deployments (8000ms) and hence T310 should be adequate to perform the measurement. This will be a simpler trigger for NB-IoT device otherwise the UE may have to keep on comparing with the threshold which may consume additional power. |
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## 4 Questions for RAN4

## 4.1 Inter-Frequency and Intra-Frequency Measurements

Inter-Frequency Measurements

One of the proposal that was discussed online was:

Inter-frequency measurement is supported for NB-IOT UEs in Connected mode for the purpose of reducing the reestablishment duration.

As part of online discussion, the agreement made was:

* Formulate a question to RAN4 regarding the support of inter-frequency measurements.

We request companies to provide their input on the formulation of question to RAN4.

**Input 1: Please Provide your Input on whether the LS should have question on Inter-Frequency measurements and if yes please provide the input that can be put forward for RAN4**

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| Company | Yes/No | Comments |
| Ericsson | Yes | As such measurements are defined by RAN4 and hence RAN2 should leave the exact work for RAN4 to do and thus RAN2 should only inform RAN4 about the background that the measurements are intended so UE should perform Intra or inter-frequency measurements before RLF in order to shorten the duration from below point C (declaring RLF) to D (start of re-establishment procedure). And mentionign that WID prohibits definign any new measurement gap.Hence we intend to provide above figure and mention the WID and with below formulationFurther, if any questions are really needed then we would like to have geneirc questions; i.e also include question for intra-frequecny measurements as belowFigure 1: Illustrations of the reference points until RLF is declared* Is it possible for the UE perform the neighbor cell intra and/or inter frequency measurement during T310?
* Is it possible for the UE to perform the neighbor cell intra-frequency measurements for cell search during ON duration time (when the UE is in active time) while data transmission and out-of-sync related measurements in the serving cell are ongoing?
* Is it possible for the UE to perform the neighbor cell intra and/or inter-frequency measurements for cell search during DRX sleep cycles? Is this feasible even for the shortest possible DRX sleep cycle, i.e., 256ms – ON duration.
* If DRX is not configured, can one assume that measurements can be performed during invalid subframes, subframes between search spaces, etc. would this duration be enough to do intra and/or inter-frequency measurements?
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Intra-Frequency Measurements

**Input 2: Please Provide your Input on whether the LS should have question on Intra-Frequency measurements and if yes please provide the input that can be put forward for RAN4**

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| Company | Yes/No | Comments |
| Ericsson  | Yes | * Is it possible for the UE perform the neighbor cell intra and/or inter frequency measurement during T310?
* Is it possible for the UE to perform the neighbor cell intra-frequency measurements for cell search during ON duration time (when the UE is in active time) while data transmission and out-of-sync related measurements in the serving cell are ongoing?
* Is it possible for the UE to perform the neighbor cell intra and/or inter-frequency measurements for cell search during DRX sleep cycles? Is this feasible even for the shortest possible DRX sleep cycle, i.e., 256ms – ON duration.
* If DRX is not configured, can one assume that measurements can be performed during invalid subframes, subframes between search spaces, etc. would this duration be enough to do intra and/or inter-frequency measurements?
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## 4.2 Gap Analysis

[[R2-2101157](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2101157.zip)] provide details that NB-IoT UE may require gaps in order to perform the measurement. Companies are requested to review the paper and provide input as what can be asked to RAN4 on gap requirement from UE.

**Input 3 Please Provide your Input on whether the LS should have question on gap analysis and if yes please provide the input that can be put forward for RAN4**

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| Company | Yes/No | Comments |
| Ericsson  | No | We just need to mention that no new gaps can be defined for this purpose and we expect RAN4 to know the gap analysis |
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## 4.3 Time Line

[R2-2100325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100325.zip) provides some questions to check with RAN4

* the time duration in which the measurement results can be thought as valid and/or the acceptable channel quality variation range.
* One Shot measurement and associated measurement occasion

[R2-2100324](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100324.zip) provides analysis that in order to try to reduce the impacts of measurement on data transmission in connected mode, the interval between the available measurement occasions may also need to be considered and the value may be at least 20ms. Does RAN2 agree? Should this be checked by RAN4.

**Input 4: Please Provide your Input on whether the LS should have question on time duration for one shot measurement and measurement occasion details; if Yes please provide the input that can be put forward for RAN4**

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| Company | Yes/No | Comments |
| Ericsson  | No | The one-shot measurement appears to be detailed and this is something RAN4 should discuss. |
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## 4.4 Measurement Assumptions

[R2-2100325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100325.zip) suggests checking feasibility of the following measurement definitions for NB-IoT to RAN4.

* The neighbor cell measurements performed by the UE in connected mode are intra-frequency measurements when anchor carrier of the current cell and anchor carrier of the neighbor cell operates on the same carrier frequency.
* The neighbor cell measurements performed by the UE in connected mode are inter-frequency measurements when anchor carrier of the neighbor cell operates on a different carrier frequency, compared to anchor carrier of the current cell.

Further [R2-2101157](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2101157.zip) suggest that RAN2 assume intra- and inter-frequency neighbor cell requirements defined for RRC\_IDLE can be applied in RRC\_CONNECTED state

**Input 5: Please Provide your Input on whether the LS should have question on the measurement assumption; if Yes please provide the input that can be put forward for RAN4**

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| Company | Yes/No | Comments |
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| Ericsson | No |  |
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## 5 draft LS

A draft LS is provided; companies are invited to provide their comments on the draft LS

”RAN2 would like to inform RAN4 that RAN2 is currently working on below objective where RAN4 is also marked as one of the responsible group.

* Specify signaling for neighbor cell measurements and corresponding measurement triggering before RLF, to reduce the time taken to RRC reestablishment to another cell, without defining specific gaps. [NB-IoT] [RAN2, RAN4].

The WI objective is to specify signaling for neighbor cell measurements and corresponding measurement triggering before RLF. Based on the below Figure provided; the intention of this Rel-17 objective can be expressed as to reduce the time between reference points C and D through specifying signalling for neighbor cell measurements and corresponding measurement triggering between reference points A and C, i.e., until RLF is declared.



Figure 1: Illustrations of the reference points until RLF is declared

RAN2 would like to request RAN4 to define the NB-IoT measurements needed in RRC Connected mode for the purpose of reducing the time duration between point C and point D; i.e between RLF declaration to start of re-establishment procedure.

One of the requirements as specified in the WID is that no new gaps need to be defined.

Below are the agreements made in RAN2 so far.

* *Enhancements to the random access procedure are not considered*
* *The solution includes reduction of the time between declaration of RLF and the start of the random access procedure (points C and D)*
* *Neighbour cells measurement (detection and measurements) are performed only on the anchor carrier*

From RAN2 perspective both Intra-Frequency and Inter-Frequency measurements are desired.

**2. Actions:**

ACTION to RAN4:

RAN2 respectfully asks RAN4 to define the needed measurements for NB-IoT devices in RRC Connected mode for the purpose of reducing the time taken between RLF declaration to start of re-establishment procedure.”

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| Company | Comments/ Questions for RAN4 |
| Ericsson | The above draft is adequate. RAN4 is marked responsible group for this WID and thus we should expect them to do this. |
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# Participant Companies Name

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| Company | Email Address |
| Ericsson | ritesh.shreevastav@ericsson.com |
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# Conclusion