**3GPP TSG-RAN2 Meeting #115-e draft\_R2-2108971**

**Online, August 16 – 27, 2021**

**Agenda Item: 9.1.2**

**Source: Huawei**

**Title: Summary of [301] RLF measurements (Huawei)**

**Document for: Discussion and decision**

# Introduction

This document is the report of the offline discussion “[AT115-e][301][NBIOT/eMTC R17] RLF measurements (Huawei)” as below:

* [AT115-e][301][NBIOT/eMTC R17] RLF measurements (Huawei)

      Scope: Progress on the open items from the summary document

      Intended outcome: Report in R2-2108971

      Deadline: Monday 23rd, 1200 UTC.

The discussion is based on the summary document in [8].

# Discussion

## Details of the criteria and configuration for starting measurements

The following proposals are made in documents [1] - [7]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2107429 [2] | Proposal 1: Re-use the relaxed monitoring criteria defined for idle mode, i.e. even if the serving cell quality is below threshold for performing connected mode measurements for RLF, the UE may choose not to perform neighbour cell measurements if (SrxlevRef – Srxlev) < SSearchDeltaP for a period of TSearchDeltaPProposal 2: Introduce a new absolute RSRP threshold in system information which, if signalled, enables the requirement to perform connected mode measurements if relaxed monitoring criteria is not met. Proposal 3: The parameters SSearchDeltaP and TSearchDeltaP may optionally be provided along with the RSRP threshold enabling the feature. If not present the UE should not enable relaxed monitoring for connected mode measurements.Proposal 4: No need to define any explicit stop condition, i.e. the UE is required to perform measurements if the serving cell quality is below the absolute RSRP threshold, and relaxed monitoring criteria (if configured) is not met – otherwise no requirement. |
| R2-2107761 [3] | Proposal 2a: The network can configure separate criteria for NB-IoT UE to trigger intra-frequency measurements and/or inter-frequency measurements in connected mode.Proposal 2b: The network can provide connected mode measurements criteria via dedicated RRC signaling. |
| R2-2107811 [5] | Proposal 2: In addition to configuring the triggering threshold for starting connected mode measurements network may also provide the list of target cells whose measurements should be prioritized. |
| R2-2108390 [7] | Proposal 1 The criteria to stop measurements should be specified to not require UE to continue performing the measurement.Proposal 2 The criteria to start/stop measurements can be configured by broadcast signaling in SIB3-NB, serving cell quality threshold for intra and inter frequency measurement can be configurated separately. |

Four companies propose to signal a serving cell NRSRP threshold for the configuration of the criteria to start the measurements ([2], [3], [5] and [7]). This is line with the agreement that the criteria is based on a combination of serving cell quality threshold and variance of the serving cell quality.

***Proposal 1:*** *The configuration of the criteria for starting the measurements include a serving cell NRSRP threshold.*

Proposal 1 was discussed during the online session and agreed.

One company proposes to configure the criteria separately for intra- and inter-frequency measurements ([3]) and one company proposes to configure the criteria separately for intra- and inter-frequency cells ([7]).

***Proposal 2:*** *Whether to have separate criteria for intra- and inter-frequency neighbour cells or separate criteria for intra- and inter-frequency neighbour measurements.*

Companies are invited to provide their view on which option to support:

a) separate criteria for intra- and inter-frequency neighbour cells

b) separate criteria for intra- and inter-frequency measurements

c) a single criteria

Companies’ inputs

|  |  |  |
| --- | --- | --- |
| **Company** | **a, b or c**  | **Detailed comments** |
| Huawei, HiSilicon | c) | The prioritisation of which cells/ carriers to prioritise can be left to the UE implementation as done today for cell selection. |
| Lenovo | b) | A separate criteria for intra- and inter-frequency measurements could give UE more information on how to perform the measurement. |
| ZTE | b) | Similar as that in RRC\_IDLE, UE can prioritize intra-frequency measurements based on a set of “easy-to-satisfy” threshold while deprioritize inter-frequency measurements with another a bit strict set of threshold. |
| Qualcomm | **b** | What exactly is meant by inter- and inter- frequency when considering RRC connected mode measurements? We propose to use consider the following two cases: Case 1: UE does not need to perform receiver re-tuning to make neighbour cell measurements (scenario A & C), Case 2: UE needs to perform receiver re-tuning to make neighbour cell measurements (scenario B, D & E). Our reply is with this in mind. This is because it is likely to take longer to do measurements if UE has to re-tune receiver hence the trigger point needs to be earlier compared to the situation where UE does not need to retune the receiver. |
| Spreadtrum | c) | Same views as Huawei. |
| Sequans | c), but  | Agree with QC comment on having retuning as the separating criterion (though intra/inter-freq/cell terminiolgy can be reused if well defined explicitly).we do not see how separate criteria will be useful and prioritizing can be left to UE implementation.However, we are OK to go with criteria separation based on retuning differentiation if there is enough support. |
| MeidaTek | **b)** | Network can prioritise intra-frequency or inter-frequency cell for cell re-establishment based on the deployment. |
| Thales | **C)** | Normal UE would do intra-first as being less complex, now introducing more stringent requirement for inter, i.e. do that earlier does not sound convincing.In general a UE should have the freedom to do intra- and inter-frequency measurements in the order it likes. So very likely that some UEs may do intra-frequency measurements first and later the more complex inter-frequency measurements. When doing inter-frequency measurements the tuning requires time, i.e. to change the oscillator.  Also the device can’t assume what is timing relation between the serving cell and the inter-frequency neighbours, hence this also may need additional time. But having a more stringent (earlier start) requirement to start inter-frequency measurements may also not help as Ue may want to do intra-frequency measurements first. Hence, we are in favor of one limit for the measurements.  |
| Ericsson | **c)** |  |
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Conclusion:

Five companies support having a common criteria and leave to the UE how to prioritise the carriers/cells that are measured. One of the company would be open to have separate criteria for intra- and inter-frequency measurements considering the need for retuning if there is a lot of support.

Four companies support having separate criteria for intra- and inter-frequency measurements. One company thinks this would help the UE to prioritise which measurements to perform. One company thinks this would help the UE prioritise intra-frequency (i.e. without need for retuning) measurements first. One company thinks that inter-frequency (i.e. needing retuning) measurements would take longer and should start earlier. One company thinks that the network may want to prioritise intra- / inter-frequency cells based on deployment scenarios.

**Proposal 2-1:** Prioritisation of carriers/cells is left to UE implementation.

**Proposal 2-2:** To further discuss whether to provide a separate criteria for inter-frequency measurements (i.e. needing re-tuning) considering that they will take longer and should start earlier.

One company proposes to reuse the existing relaxed monitoring criteria and optionally signal SSearchDeltaP and TSearchDeltaP parameters to enable it. This is line with the agreement that the criteria is based on a combination of serving cell quality threshold and variance of the serving cell quality.

***Proposal 3:*** *The configuration of the criteria for starting the measurements optionally includes SSearchDeltaP and TSearchDeltaP parameters to enable relaxed monitoring.*

Proposal 3 was discussed during the online session without conclusion and it was left FFS how to address variance (as agreed last meeting).

Companies are invited to provide their view on how to address the variance of the serving cell quality:

a) The configuration of the criteria for starting the measurements optionally includes SSearchDeltaP and TSearchDeltaP parameters to enable relaxed monitoring

b) Other (please describe)

Companies’ inputs

|  |  |  |
| --- | --- | --- |
| **Company** | **a or b** | **Detailed comments** |
| Huawei, HiSilicon | **a)** | This addresses the variance aspect of the agreed criteria and reused an existing mechanism.We think separate parameters from RRC\_IDLE should be signalled as the timeline will be very different. |
| Lenovo | a) | We hope this is an optionally procedure, and no other new mechanism will be introduced to define the UE moving or not, just reuse the legacy relaxed criteria with sperate parameters. |
| ZTE | **a)** | Agree with HW that separate serving cell quality variance parameters from RRC\_IDLE would be suitable. For example, TSearchDeltaP might be shorter than 5 minutes since it’s for evaluation during connected mode. |
| Qualcomm | **a** |  |
| Spreadtrum | **a)** | We think the variance of the serving cell quality should be supported optionally. It can reuse the existing relaxed mechanism with separate parameters. |
| Sequans | **a** | Agree with HW |
| MediaTek | **a)** | Agree with HW and ZTE. |
| Thales | **a)** | Agree with lenovo here. We don’t need to define new mechanism or definition of moving UE. Legacy relax monitoring criteria can be used. |
| Ericsson | **a) but** | We wonder whether NRSRP measurement is already filtered, i.e., L1 and if relaxed monitoring criteria is to be used it would take quite long for the UE to conclude considering that UE is in connect mode for a very limited time.  |
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Conclusion:

All companies agree with option a) relaxed monitoring to address the variance part of the criteria. Four companies indicate that separate parameters from RRC\_IDLE should be provided considering the time line. Two companies comment that we should not define a new mobility criteria and that the legacy relaxed monitoring should be used with different parameters. One company thinks this should be optional. One company thinks the relaxed monitoring criteria may never be fulfilled considering short lived connections.

**Proposal 3.1**: Legacy relaxed monitoring criteria is reused to address the variance part of the criteria to start the measurements.

Proposal 3.2: Discuss whether relaxed monitoring criteria in RRC\_CONNECTED is enabled by the provision of separate SSearchDeltaP and TSearchDeltaP parameters from RRC\_IDLE or it can also be enabled with same parameters as for RRC\_IDLE.

Two companies propose that the conditions where the UE is not required to perform measurements are specified, both assume that this can be a counterpart of the starting criteria and be implicit ([2] and [7]).

***Proposal 4:*** *The conditions where the UE is not required to perform measurements are specified. No additional configuration is needed.*

Companies are invited to provide their view on whether they agree on the proposal 4.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **Yes** | We think that the conditions when the UE is required to perform measurements should be specified. When the conditions are not fulfilled, it is up to the UE implementation and no specific configuration is needed to stop. |
| Lenovo | Yes | UE implementation may be suffcient unless some issue is identified. |
| ZTE | Agree with HW but it doesn’t mean Yes to proposal 4? | Agree with HW that only the conditions when the UE is required to perform measurements should be specified. No specific configuration is needed for stop.Moreover, as mentioned in previous meeting, we think as long as the measurement is started, it’s more reasonable to let the UE complete at least one measurement. UE can stop the measurement after getting the results (may also according to RAN4 requirements). If UE may temporarily stop or interrupt the measurement, it will cause the measurement previously performed in vain and cause unnecessary waste. On the other hand, we worry about that a stop criteria may cause the ping-pong of start and stop measurement. |
| Qualcomm | **Yes** | The current specification for relaxed neighbour cell measurements is a a guide for the UE, not a requirement hence it is left to UE implementation whether such relaxation is support or not. |
| Spreadtrum  | **Yes** | After starting the measurement, whether to stop measurement is up to UE implementation and no additional condition is needed. |
| Sequans | **See comment** | Agree with ZTE that stopping is best left to UE implementation. There seems to be a confusion about the meaning of Yes/No to this question |
| MediaTek | **Yes** | Agree with Spreadtrum. |
| Thales | **Yes** |  |
| Ericsson | **Yes** |  |

Conclusion:

All companies agree that when to stop the measurement can be left to the UE implementation.

**Proposal 4:** The conditions where the UE is required to perform measurements are specified. No requirement on when to stop measurements is needed.

Two companies propose that the configuration of the criteria is provided via broadcast signalling ([2] and [7]). One company proposes that the configuration of the criteria is provided via dedicated signalling ([3]). One company does not clarify ([5]).

***Proposal 5:*** *The configuration of the criteria for starting the measurements is provided via broadcast signalling.*

Companies are invited to provide their view on whether they agree on proposal 5.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **Yes** |  |
| Lenovo | **Yes** | Consider the UE is moving, this method could make UE obtain this information more ealier than dedicated method, although it may be not UE specific value. |
| ZTE | **No** | As this configuration is used by UE in connected mode, we think it’s more suitable to be provided via dedicated signalling. We cannot understand what’s the benefit of “early” provision in SIB. Provision during RRC establishment procedure is already early enough.Moreover, we assume network can provide such configuration with additional consideration on some aspects, e.g., UE’s RA performance or scheduing parameter configuration etc.  |
| Qualcomm | **Yes** |  |
| Spreadtrum | **Yes** | We think it is not necessary to make the UE specific configuartion. Therefore, it is naturally to provide the configuration information via broadcast signalling. |
| Sequans | **Yes, but** | We currently see no compelling reason to have different configuration of threshold per UE. However, we are OK to continue discussing as well.  |
| MediaTek | **Yes** |  |
| Thales | **Yes** |  |
| Ericsson | **Yes** |  |

Conclusion:

Eight out of nine companies support configuring the criteria for starting the measurementsvia broadcast signalling.

**Proposal 5:** The configuration of the criteria for starting the measurements is provided via broadcast signalling.

## Whether any further information needs to be provided by the NW

The following proposals are made in documents [1] - [7]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2107122 [1] | Proposal 1: In RRC connected state, measure one or more of the strongest neighbour cells measured in RRC idle state.Proposal 2: In RRC connected state, measure one or more of the strongest neighbour cells measured in RRC idle state that do not require receiver re-tuning. |
| R2-2107429 [2] | Proposal 5: No additional new information needs to be configured by the NW (other than the parameters defining the measurement start conditions, and (FFS) RLF triggering timer). |
| R2-2107761 [3] | Proposal 3: Network can provide measurement configuration to the UE, e.g., the neighbor frequency, neighbor cells via dedicated RRC signaling. |
| R2-2107810 [4] | Observation 1: System Information acquisition time reduction during re-establishment can improve the overall Re-establishment time upto 40% compared to current performance.Observation 2: If the connected mode measurement of the selected target cell is not available within configured time prior to RLF there will not be any improvement for re-establishment time reduction if other delay components are not optimised.Observation 3: The impact of system information time reduction on re-establishment is higher than 40% if all the system information acquisition needed for RACH access is considered in the overall time estimation.Observation 4: The reasons SI periodicity is set high is to limit the resource used/overhead for SI messages. SI messages are sent with multiple repetitions to enable different coverage enhancement scenarios. Observation 5: For cell reselection cases for re-establishment the system information acquisition for SIB1-NB will further increase the delay of re-establishment. Observation 6: For re-establishment scenarios UE may start random access with minimum system information acquisition and network may provision all the dedicated configurations explicitly as part of re-establishment procedure in this case.Proposal 1: RAN2 to consider network assistance to UE related to minimum system information required for random access as part the signalling procedures defined for measurements and measurement triggering.Proposal 2: Network assistance information containing the potential target cell identifiers is supported for connected mode measurements for RLF.Proposal 3: RAN2 consider inclusion of target cell system information as a variation to the serving cell in the assistance information to minimise the system information acquisition for Re-establishment. |
| R2-2107811 [5] | Proposal 2: In addition to configuring the triggering threshold for starting connected mode measurements network may also provide the list of target cells whose measurements should be prioritized. |
| R2-2108390 [7] | Proposal 3 It is up to UE implementation to choose and prioritize carrier/cell list for measurement.  |

Three companies indicate that there is no need for the network to provide additional information regarding which cells/carriers to be considered, RRC\_IDLE mode configuration can be used ([1], [2], and [7]). Among these companies, one company proposes to define rules for prioritisation at the UE ([1]) and two companies think prioritisation can be left to the UE implementation ([2] and [7]). Two companies propose that the network provides the list of target cells whose measurements should be prioritized ([3], [4] and [5]).

***Proposal 6:*** *Provision of additional information regarding which cells/carriers to be considered is not supported. It is up to UE implementation to choose and prioritize carrier/cell list for measurement.*

Companies are invited to provide their view on whether they agree on proposal 6.

Companies’ inputs

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **Yes** | This is the same as for cell selection. |
| Lenovo | **Yes** |  |
| ZTE | **No** | About by UE implementation, we assume generally UE may make use of historical information or the broadcasted neighbor cell lists. But:* For UE with continuous movement, we think the historical information may be not so stable and then become less useful.
* For broadcasted neighbor cell lists, as they are cell-specific and can be used by all the UEs, it may be still “too large” for a certain UE to perform connected mode measurement.

Therefore, we still think it would be better to let network provide the list of target frequencies/cells via dedicated signalling. For example, by distinguishing whether UE accesses at the cell centre or at the cell edge, the network can provide different lists. Furthermore, for the UEs that access at the cell edge, network may not be able to exactly identify which part of cell edge (assuming the cell is large). But if UE can report some information to network during RRC establishment/resume procedure, e.g., the second best cell before random access, it would be useful for network to provide limited measurement range for different UEs.  |
| Qualcomm | **Yes** | Proposal 1 and 2 in [1] propose UE to prioritise known cell over unknown cells as there will be limited time to do neighbour cell measurements in RRC connected state. |
| Spreadtrum | **Yes** |  |
| Sequans | **Yes** | Additional information is only practical if very small (on very few neighbouring cells), in which case we are not convinced it will be generally very useful and not result in overall worse power consumption; this is doubly true if assistance information from the UE is needed as well.  |
| MediaTek | **Yes** | Historical information would be enough for performing measurement in connected mode. |
| Thales | **Yes** |  |
| Ericsson | **Yes** |  |

Conclusion:

Eight out of nine companies support the proposal.

**Proposal 6:** Provision of information regarding which cells/carriers to be considered is not supported. It is up to UE implementation to choose and prioritize carrier/cell list for measurement.

One company proposes to provide the UE with minimum system information for the target cell(s?) to minimise the delay for system information acquisition ([4]). No other contribution addresses the topic although it was already proposed in the last meeting.

***Proposal 7:*** *Provision of minimum system information for the target cell(s) to minimise the delay for system information acquisition is not supported.*

Companies are invited to provide their view on whether they agree on proposal 7.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **Yes** | We cannot see how the eNB will select the cells for which to provide information, this would add a lot of signalling overhead and will also impact RAN3. |
| Lenovo | **Yes** |  |
| ZTE | **Yes** | Agree with Huawei. |
| Qualcomm | **Yes** | It is easy to say ‘provide minimum system information’ but what system information and would this be same for all neighour cells? Without a concrete example of what system information can be provided and how this would help reduce the time to re-establish, it is a hypothetical proposal. |
| Spreadtrum | **Yes** |  |
| Sequans | **Yes** | Agree with HW, QC |
| MediaTek | **Yes** | The minimum system information can help to improve the mobility, however the impact on spec is large and beyond the WI's scope. |
| Thales | **Yes** |  |
| Ericsson | **Yes** |  |

Conclusion:

All companies agree with the proposal.

**Proposal 7:** Provision of minimum system information for the target cell(s) to minimise the delay for system information acquisition is not supported.

## Whether any assistance information from UE is needed.

The following proposals are made in documents [1] - [7]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2107122 [1] | Proposal 4: In RRC connected state, support UE indication requesting relaxed scheduling to perform neighbour cell measurements. |
| R2-2107429 [2] | Proposal 6: No assistance information from the UE needs to be specified. |
| R2-2107761 [3] | Proposal 4: The measured cell in idle mode can be sent from UE to the network to facilitate eNB to provide more suitable measurement configuration. |
| R2-2107811 [5] | Observation 1: Triggering of connected mode measurements at suitable time is key factor for optimised Re-establishment performance. Assistance information on the impact of measurement configuration on Re-establishment is essential to optimize the configuration.Proposal 1: RRC Re-establishment complete message sent after RLF with connected mode measurement include additional information about connected mode measurements such as duration and time gap between measurements and Re-establishment starting point. FFS additional parameters. |
| R2-2108390 [7] | Proposal 4 Assistance information from UE is not needed.Proposal 5 It is not needed for UE to report when it starts/stops measurements. |

One company proposes that the UE reports an indication when it starts/stops perform neighbour cell measurements to enable ‘relaxed’ scheduling [1]. Two companies think it is not needed ([2], [7]).

***Proposal 8:*** *Indication from the UE that it starts/ stops performing measurement is not supported.*

Companies are invited to provide their view on whether they agree on proposal 8.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **Yes** | This could potentially be beneficial for the eNB to adapt the scheduling to provide sufficient gaps. However, we think the use case of RLF measurements is mobile UEs that would be in relatively good coverage and should be able to find gaps of 400 ms. Introducing a new reporting will require new signalling procedure and additional signalling overhead. We think that eNB can also provide some more suitable DRX / PDCCH SS configuration for UE supporting this feature. |
| Lenovo | Yes |  |
| ZTE | **Yes** | Agree with Huawei such report may be beneficial for allowing more flexible scheduling in network. But the specification impacts and signalling overhead are considerable. Moreover, based on our analysis, we see it’s possible for network to provide free subframes for UE to perform connected mode measurement. Then it’s less needed to define explicit measurement start/stop indications. |
| Qualcomm | **No** | To allow for optimal scheduling it is good for network to know when UE actually needs free subframes to perform neighbour cell measurements. Otherwise you end-up with one of two extreme cases, which can easily happen if all neighbour cells have the same anchor carrier frequency but UE configured on non-anchor carrier: Case 1 - not sufficient subframes available for UE to perform neighbour cell measurements because of the need for receiver re-tuning, Case 2 – network always provides scheduling such that free subframes are available but UE does not need to perform any measurements. For this reason to make this feature more usable and still maintain good throughput it is recommended UE can signal to the network when it needs more free subframes than that are possible with eh current configuration/scheduling.  |
| Spreadtrum | **Yes** | Since the UE might use the natural gap to do the measurement, it is not necessary for UE to notify eNB about the occasion that it starts/stops performing the measurement. |
| Sequans | **Maybe** | Generally agree with HW’s comments that this can be useful as an optimization; However, it could be quite valuable still, so we would prefer to agree to keep this as second priority in case time allows. |
| MediaTek | **Yes** | The indication from UE is not desirable for potential frequent measurement start/stop.  |
| Thales | Yes | An extra indication is not required by UE to send.  |
| Ericsson | Yes |  |

Conclusion:

Seven out of nine companies agree with the proposal, some indicate concerns about the signalling overhead and specification impact. One company comments that it is needed for optimal scheduling. One company thinks it could be a useful optimisation and could be considered as second priority.

**Proposal 8:** Discuss whether indication from the UE that it starts/ stops performing measurement is not supported.

One company proposes that the UE reports the measured cell(s) in RRC\_IDLE to assist measurement configuration by the network [3]. Two companies think it is not needed ([2], [7]).

***Proposal 9:*** *Report of the cells measured in RRC\_IDLE to assist measurement configuration is not supported.*

Companies are invited to provide their view on whether they agree on proposal 9.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **yes** | This cannot apply to UEs that use the CP solution which is the vast majority (if not all) the UEs. In addition we do not think this would be particularly useful, the information could easily become out of date during a long connection, and the information broadcast in system information should already be sufficient. |
| Lenovo | Yes |  |
| ZTE | **No** | See our comments for proposal 6. We prefer UE can be provided with a limited measurement range. If a UE can report some information to network during RRC establishment/resume procedure, e.g., the second best cell it has seen before random access, it would be useful for network to provide limited measurement range for different UEs. Such report can be optional and mainly used by UE with UP solution. |
| Qualcomm | **Yes** | Providing neighbour cell measurements without security is not acceptable. As pointed out during on-line discussion, one key use case for NB-IoT connected mode measurements is to improve tracker performance hence providing neighbour cell measurements without security is a major flaw. |
| Spreadtrum | Yes |  |
| Sequans | Yes | Agree with HW, QC |
| MediaTek | Yes |  |
| Thales | Yes | Agree with Qualcomm here |
| Ericsson | Yes |  |

Conclusion:

Eight companies out of nine support the proposal, one concern is security.

**Proposal 9:** Report of the cells measured in RRC\_IDLE to assist measurement configuration is not supported.

One company proposes that the UE reports information of connected measurements during the RRC Connection re-establishment procedure for network optimisation [5]. One company thinks it is not needed ([2]).

***Proposal 10:*** *Report of information about connected measurements during the RRC Connection re-establishment procedure for network optimisation is not supported.*

Companies are invited to provide their view on whether they agree on proposal 10.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **Yes** | We see this a SON-MDT enhancement which is not really part of the objective. This cannot apply to UE that uses the CP solution which is the vast majority (if not all) of NB-IoT UEs. This would also impact on RAN3. |
| Lenovo | Yes |  |
| ZTE | **Yes** | Considering limited time for R17 discussion, we need to fucus on basic functions. So such enhancement can be left to future release. |
| Qualcomm | **Yes** | As per our reply to previous Proposal (9), providing report of neighbour cell measurements without security is not acceptable. |
| Spreadtrum | Yes |  |
| Sequans | Yes | Agree with HW, QC |
| MediaTek | Yes |  |
| Thales | Yes |  |
| Ericsson | Yes |  |

Conclusion:

All companies agree with the proposal.

**Proposal 10:** Report of information about connected measurements during the RRC Connection re-establishment procedure for network optimisation is not supported.

## If/how to support “early” RLF

The following proposals are made in documents [1] - [7]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2107122 [1] | Observation 1: Not clear whether early RLF can in most cases lead to reduced time to complete data transfer.Observation 2: Early RLF could lead to increased common radio resource usage and increased network signalling.Proposal 3: For NB-IoT early RLF is not considered. |
| R2-2107761 [3] | Proposal 1: Early RLF is not introduced into NB-IoT. |
| R2-2107811 [5] | Observation 1: Comparative performance evaluation of early RLF against the RLF declaration of T310 expiry is not available for RAN2 decision on early RLF.Observation 2: Work Item scope is limited to measurements and measurement triggering for RLF. Changes to RLM functionality is not in scope.Proposal 3: Early RLF is considered only if benefits are established and WID scope should be updated for the impact to RLM. |
| R2-2107869 [6] | Observation 1: Reducing the time corresponding to cell selection will only bring marginal benefits for good coverage UEs, i.e. a couple of 100 ms.Observation 2: The broadcast value of T310 is usually targeted to stationary UEs with short-lived connection and set to a large value.Observation 3: For mobile UEs at the edge of the cell, a shorter T310 will reduce the interruption time and improve the user experience.Observation 4: Using a shorter T310 always will reduce the chance of recovery for UEs not at the cell edge or not moving.Proposal: Introduce an alternative shorter T310 timer that the UE uses to trigger RLF when at least the following condition is fulfilled:‐ The criteria for performing connected mode measurements is fulfilled (i.e. degrading serving cell quality) ‐ FFS other conditions. e.g. RAI, target cell quality |
| R2-2108390 [7] | Observation 1 Fast RLF was introduced for HetNet scenario. Fast RLF needs a variety of adaptions for NB-IoT.Proposal 6 Fast RLF should not be considered. |

Four companies propose that early RLF for NB-IoT is not supported ([1], [3], [5] and [7]) on the ground that the benefit is not clear, that it can lead to additional resource usage, that early RLF (T312) was introduced for Hetnet, cannot be reused directly and impacts the RLM procedure which is outside of the WID scope.

Nine companies propose to configure an alternative shorter T310 timer that the UE uses when certain conditions are fulfilled ([6]). A shorter T310 timer does not change the RLM procedure and the value is in under network control as it is today.

***Proposal 11:*** *[To agree] Configuration of an alternative shorter T310 timer that the UE uses when the criteria for performing connected mode measurements is fulfilled is supported. Need for other conditions is FFS.*

Proposal 11 was discussed during the online session with the following conclusion:

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| --- |
| Agreements:* It is useful to have a shorter T310 timer for UEs supporting this enhancement, but FFS whether this is best achieved with the existing dedicated signalling or based on a new condition
 |

Companies are invited to provide their view on to achieve a shorter timer for UEs supporting this enhancement:

a) Whether this should be based on an alternative timer that the UE can only use under certain conditions. Please clarify what the condition (s) could be.

b) Whether this is based on the existing T310 timer provided in RRC dedicated signalling. Please clarify whether additional conditions are needed.

c) other

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Preferred Option** | **Detailed comments** |
| Huawei, HiSilicon | **a)** | For both a) and b) supporting the connected mode measurements is not a sufficient condition for using a shorter T310 timer. In our view, as a minimum, an additional condition on UE mobility is required. In addition, a condition on UE having found another cell would be preferable.  |
| Lenovo | a) | In order to suppor the UE move fastly among cells with service continuity, we think the dedicated T310 may be not effcicent since the network may not have sufficient measurement information to determine the value of the dedicated T310 value. |
| ZTE | **b)** | With the following reasons, we prefer to use existing T310 timer provided in RRC dedicated signalling and no need to define additional condition.1. The current dedicated signalling can already allow shorter T310 timer configuration for a certain UE, e.g., according to UE’s coverage. If a UE is in very good coverage, it’s much likely to be configured with shorter T310, e.g., 2s. But if the UE’s coverage is not so good, it may be configred with a bit longer value (still shorter than 8s). This is already with consideration for trade-off between quick reselection to new cell and enough time for recovery (in a not so good coverage, DL/UL repetitions are anyway needed for in-sync indications reception). So the first concern for a) is that, even the so-called conditions are introduced and fulfilled, an absolution shorter value, e.g., 2s, may not suitable to the related R17 UEs.
2. Even we can have a kind of common understanding that R17 UEs may be with continuous movement, there may have no common assumption the long connection. It’s still possible for UE to only have a few data for transmission, the each time connection may be not long or short. For such UE, it’s likely to use CP solution and we can assume the dedicated T310 configured at each RRC establishment/resume procedure would be always suitable during the whole connection. If UE has more data for transmission, it’s likely to use UP solution and maintain long connection. For such UE, the situation may change a lot. When such case occurs, it’s possible for network to reconfigure the UE with another suitable T310 value. Moreover, we don’t think network need to rely on UE’s report, the evaluation on DL/UL service quality can provide enough information to network.
3. In [R2-2107869], companies also mention using a shorter T310 will reduce the chance of recovery for UEs not at the cell edge and experiencing temporary or locally bad radio conditions. We cannot see big difference between using 2s and 8s. Taking the whole RLF procedure into consideration, for a **temporary** radio condition deterioration, the “recovery” may happen at any stage. The only case with benefit of long T310 may be that the "in-sync" indications are received after the T310 runs for 2s but before 8s. We think it would be very rare case. In other cases (as following), it’s hard to say such benefit (or hard to say the drawbacks of short T310). For examle:
	* The UE may not receive enough N310 consecutive "out-of-sync" indications to trigger T310. Then it doesn't matter to use T310 of 2s or T310 of 8s.
	* "in-sync" indications occurs just after T310. Since the UE is originally in good coverage, 2s may be enough for UE to receive them.
	* If the radio condition deterioration is not temporary, "in-sync" indications may hardly occur, even 8s may be not long enough.

In a summary, without crystal clear benefit, such complexity of handling at least three configured T310 values is unnecessary. |
| Qualcomm | **b** | We think existing timer can be used and network can configure a shorter value via dedicated signalling based on the information eNB has about the UE/subscription. This may mean that RLF gets triggered earlier for the case UE does not actually trigger measurements but we don’t think this is a big drawback.With option a) We think because the condition to start T310 may occur before measurements are triggered and in that case, as per the on line discussions, the legacy T310 will be started hence you end-up with different behavour from the same UE depending on measurements were triggered or not. |
| Spreadtrum | **a)** | Same view as Huawei. |
| Sequans | **b)** | Generally agree with ZTE. We may suggest a WF by combining with the discussion for Proposal 8: If UE indicates that it started measurements it may also indicate if it requires higher/lower T310, and the rest can be left to implementation.From above comments it also seems that there are two differing understandings – whether declaring RLF early is valuable only after an alternative cell has already been identified or after a short period of time when recovery is less likely. |
| MediaTek | **a)** | Agree with Huawei.The network cannot know if the UE is in moving when establishing a connection and the coverage state can easily change when moving. Thus the UE needs a more dynamic mechanism to improve mobility. Finding another cell would be a good condition to trigger a shorter T310 timer. |
| Thales | **b)** | We think existing timer is enough and that can be configured. |
| CMCC | **a)** | Same view as Huawei. |
| Ericsson |  | We have no strong opinion. If existing timer can work then it is preferred else if there is companies show string motivation to have a separate timer we can consider it based upon UE capability. |

Conclusion:

Five companies support option a) (alternative timer that can be used in certain conditions), the motivation is that the eNB cannot know the actual UE mobility.

Four companies support option b). Two of them think that UEs will long connection shall use the UP solution and so they can be reconfigured by the eNB.

One company has no strong opinion and would prefer option b) if feasible or a separate timer based on UE capability.

**Proposal 11:** To continue discussing which approach (which option a) or b)) to pursue.

## Other

The following proposals are made in documents [1] - [7]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2107761 [3] | Observation 1a: In order to provide a single measurement occasion of length 400ms or 2000ms, the long DRX cycle would be required for supporting 400ms or 2000ms OFF period in a DRX cycle.Observation 1b: If using DL gap, a single measurement occasion of length 2000ms cannot be provided in any configuration and 400ms measurement occasion can only be provided with few configuration. Such restriction on eNB configuration is almost unacceptable.Observation 1c: If using NPDCCH gap, in order to provide a single measurement occasion of length 400ms or 2000ms, there is also much restriction on the scheduling parameters configuration.Proposal 5: OFF period of DRX can be used for the neighbour cell measurement under scenario B, D and E. |
| R2-2108390 [7] | Proposal 7 UE capability for connected mode measurement is optional and without signaling to NW. |

One company proposes that the OFF period of DRX can be used for the neighbour cell measurement under scenario B, D and E.

***Proposal 12:*** *Whether OFF period of DRX is used for the neighbour cell measurement under scenario B, D and E.*

Companies are invited to provide their view on whether OFF period of DRX is used for the neighbour cell measurement under scenario B, D and E.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **No?** | we do not think it needs to be specified which gaps the UE is using,DRX off period is an obvious option, but there are other, e.g. gaps between two Search Space when the UE is not scheduled.  |
| Lenovo | No | Same view as Huawei. |
| ZTE | **No?** | Such analysis is useful for us to determine whether it’s possible to use scheduling “gap” for measurement. We tend to agree maybe no specification impacts for this part. |
| Qualcomm | **Yes** | This has already been confirmed by RAN4 i.e., UE can use any subframes not needed to receive/send on dedicated channels to make neighbour cell measurements in scenario B, D & E.Whether this needs to be specified in RAN specs is a separate question. We don’t think anything needs to be specifed in the spec. |
| Spreadtrum | **No** | It does not need to be specified. The gaps used for measurement can be left to UE implementation. |
| Sequans | **Yes? No?** | It is likely going to be used, but does not need to be specified |
| MediaTek | **No** | Agree with spreadtrum. |
| Ericsson | **No** | Agree with spreadtrum |

Conclusion:

All companies agree that there is no need to specify what subframes can be used beyond the RAN4 requirements that the subframes are not needed for PDCCH monitoring or data transmission/ reception.

**Proposal 12:** There is no need to specify which subframes can be used for measurements beyond them not being needed for PDCCH monitoring or data transmission / reception.

One company proposes that UE support for connected mode measurement is optional without capability signalling. Note that RAN2#113-e has already that the feature was optional.

***Proposal 13:*** *Support for connected mode measurement is optional without capability signalling.*

Companies are invited to provide their view on whether they agree on proposal 13.

Companies’ inputs

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| --- | --- | --- |
| **Company** | **Agree:** **Yes/No** | **Detailed comments** |
| Huawei, HiSilicon | **No** | We think it could be useful for the NW to be informed about the UE capability, e.g. for configuration of DRX, PDCCH Search space, T310 of for being aware that UE may be using a shorter T310. |
| Lenovo | No | Same view as Huawei. |
| ZTE | **No** | We also think UE capability would be needed, not only for facilitating more suitable DRX, PDCCH Search space configuration, but also for facilitating dedicated measurement configuration. |
| Qualcomm | **No** | We think network does need to know whether UE supports neighbour cell measurements, otherwise depending on configuration/scheduling UE may not be able to perform neighbour cell measurements. This is also related to our response to proposal 8. |
| Spreadtrum | **No** | Same view as Huawei. |
| Sequans | **No** | It is optional, but capability signalling is required, as described above. |
| MediaTek | **No** | Agree with Huawei |
| Thales | **No** |  |
| Ericsson | **No** |  |

Conclusion:

No company agrees with the proposal.

**Proposal 13:** Support for connected mode measurement is optional with capability signalling.

# Conclusion

TBC

#  Participants

|  |  |  |
| --- | --- | --- |
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# References

1. R2-2107122 Consideration on neighbour cell measurement in RRC connected state Qualcomm Incorporated
2. R2-2107429 Open issues on connected mode measurements for RLF Huawei, HiSilicon
3. R2-2107761 Remaining issues on connected mode measurement ZTE Corporation, Sanechips
4. R2-2107810 Network assistance information for Re-establishment time reduction
5. R2-2107811 On the open aspects for connected mode measurements for RLF enhancements
6. R2-2107869 Triggering cell selection early Huawei, HiSilicon, MediaTek Inc., Spreadtrum Communications, Lenovo, Motorola Mobility, Fraunhofer, Novamint, CMCC, China Unicom, Reliance Jio
7. R2-2108390 Discussion on connected mode measurement in NB-IoT Ericsson discussion
8. R2-2108843 Summary of AI 9.1.2 NB-IoT neighbor cell measurements (Huawei) Huawei Report