3GPP TSG-RAN WG2 Meeting #116 Electronic R2-210xxxx

Elbonia, 01 – 12 November 2021

**Agenda item: 8.13.3.2**

**Source: Nokia (Rapporteur)**

**Title: [Post115-e][896][SON/MDT] Logged MDT (Nokia)**

**WID/SID: NR\_ENDC\_SON\_MDT\_enh-Core - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

* [Post115-e][896][SON/MDT] Logged MDT (Nokia)

 Scope:

 - Clarifications related to early measurements logging in logged MDT report

 - Frequency-specific and RAT-specific coverage hole indication in logged MDT report and its associated configuration

 - Enhancements associated to CEF report and RLF report for UL/DL coverage imbalance issues

 Intended outcome: Report

 Deadline: October 21th

The discussion is targeting to progress objective of the Rel-17 WI on enhancement of data collection for SON/MDT ([RP-201281)](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_88e/Docs/RP-201281.zip) in context of Logged MDT.

The discussion is organized as follows:

Phase I: progress open points, deadline October 18th

Phase II: formulate conclusive proposals resulting from phase I discussion, deadline October 21th

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Nokia (Rapporteur) | Malgorzata Tomala | malgorzata.tomala@nokia.com |
| OPPO | Liu Yang | liuyangbj@oppo.com |
| Qualcomm | Rajeev Kumar | rajeevkr@nyu.edu |
| CATT | Jie Shi | Shijie@catt.cn |
| Ericsson | Pradeepa Ramachandra | pradeepa.ramachandra@ericsson.com |
| Huawei, HiSilicon | Jun Chen | jun.chen@huawei.com |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# 3 Discussion

### 3.1 Early measurements logging in logged MDT

For early measurements logging in the Logged MDT, the following RAN2 agreements have been made:

RAN2#113-e:

Agreement:

 The network can use a flag in logged MDT configuration to indicate if an early measurement/idle mode configuration has relevance for logged measurement purposes. Upon such an indication, UE can log measurements on non-cellReselection (carrier frequencies not part of SIB4 or SIB5). AreaConfig and/or InterFreqTargetInfo can be used for filtering of SIB4 and non-SIB4 frequencies. Whether a flag is needed should be FFS.

**Observation 1:** LoggedMeasurementConfiguration can use a flag to indicate if an early measurements/idle mode configuration has relevance for logged measurement purposes. Whether a flag is needed should be FFS.

**Observation 2:** Based on the flag, theUE can log measurements on non-cellReselection (carrier frequencies not part of SIB4 or SIB5).

**Observation 3:** AreaConfig and/or InterFreqTargetInfo can be used for filtering of SIB4 and non-SIB4 frequencies.

The identified FFS whether a flag is needed wasn’t resolved so far. Hence, further understanding is required on what effect the flag could take. EMR configuration is given by RRCRelease with MeasIdleConfig configuring MeasIdleCarrierNR, and MeasIdleCarrierEUTRA with (optionally) validity area set the area scope for idle measurements, thus it can be assumed that Early Measurements require set of pre-configured frequencies. In addition, the configuration (see Annex A) implies specific, different that in Logged MDT, measurement performance. Enabling logging of early measurements in Logged MDT framework, by the flag could imply the following options:

**Option 1** (Explicit flag: EMR configuration and EMR measurement performance on top of extended Logged MDT):

1. The network configures the flag to indicate if an early measurement/idle mode configuration has relevance for logged measurement purposes (regardless of extended *AreaConfig* and/or *InterFreqTargetInfo)*
2. *RRCRelease* with *MeasIdleConfig* configures *MeasIdleCarrierNR*, and *MeasIdleCarrierEUTRA* (applicable for EMR configuration with (optionally) validity area (see the Annex A) takes the precedence in determining the measurements results in the Logged MDT report for EMR purpose
3. The UE performs measurements results according to 5.5a.3 (legacy MDT rules) and 5.7.8.2a (Note: different measurement performance applies than legacy rules for Logged MDT)(see Annex A)
4. The Logged MDT report is determined according to:
* Legacy MDT configuration, performing measurements defined in 5.5a.3 (legacy MDT rules with periodical and event-based triggers), and on top of that:
* Detailed configuration parameters of the idle measurement configuration (report quantity, quality threshold, etc) for EMR purpose, and
* Extended *AreaConfig* and/or *InterFreqTargetInfo* (if present), following legacy Logged MDT performance measurements defined in 5.5a.3 (legacy MDT rules)

**Option 2** (Explicit flag, but either EMR configuration and EMR measurement performance or extended Logged MDT):

1. The network configures the flag to indicate if an early measurement/idle mode configuration has relevance for logged measurement purposes with dependence of extended *AreaConfig* and/or *InterFreqTargetInfo*
	1. If extended *AreaConfig* and/or *InterFreqTargetInfo* is not present 🡪 apply Option1
	2. If extended *AreaConfig* and/or *InterFreqTargetInfo* is present 🡪 igore the flag

The extended area scope sets the frequencies for non-cellReselection frequencies. I.e. *RRCRelease* with *MeasIdleConfig* configuring *MeasIdleCarrierNR*, and *MeasIdleCarrierEUTRA* (applicable for idle mode measurement configuration with (optionally) validity area) is not used for determining the measurements results in the Logged MDT report

1. The UE performs measurements results according to:
	1. Option 1
	2. 5.5a.3 (legacy MDT rules) with extended set of frequencies (report quantity, quality threshold, etc for ERM do not apply)
2. The Logged MDT report is determined according to:
	1. Option 1
	2. Extended *AreaConfig* and/or *InterFreqTargetInfo* (if present), following legacy Logged MDT performance measurements defined in 5.5a.3 (legacy MDT rules)

NOTE: Measurement values related to ERM carriers are logged in Logged MDT report without checking *qualityThreshold* criterion configured in ERM configuration.

The third Option assumes that enhanced MDT area configuration, that would target frequencies preconfigured for ERM purposes can serve the purpose, as the extended LoggedMDT with *AreaConfig* and/or *InterFreqTargetInfo* defining set of frequencies enables the data collection in wider scope of the frequencies (than in Rel-16 MDT). However, it assumes simplified alternative in terms of measurement performance and enable only legacy (MDT-type) measurement performance. Hence, the option assumes the extended LoggedMDT with *AreaConfig* and/or *InterFreqTargetInfo* presence implicitly indicates the wider frequencies scope for idle measurements, following the legacy MDT measurement performance, with no need to support the separate flag.

**Option 3** (implicit EMR configuration by extended Logged MDT by *AreaConfig* and/or *InterFreqTargetInfo*):

1. The network does not use an explicit flag, but extended *AreaConfig* and/or *InterFreqTargetInfo* in case an early measurement/idle mode configuration frequencies has relevance for logged measurement
	1. If extended *AreaConfig* and/or *InterFreqTargetInfo* is not present 🡪 Logged MDT applies (with no EMR purpose)
	2. If extended *AreaConfig* and/or *InterFreqTargetInfo* is present it sets the frequencies for non-cellReselection frequencies by reusing EMR frequencies
2. The UE performs measurements results according to:
	1. 5.5a.3 (legacy MDT rules)
	2. 5.5a.3 (legacy MDT rules) with extended set of frequencies
3. The Logged MDT report is determined according to:
	1. Legacy MDT configuration, performing measurements defined in 5.5a.3 (legacy MDT rules with periodical and event based triggers)
	2. Extended AreaConfig and/or InterFreqTargetInfo, following legacy Logged MDT performance measurements defined in 5.5a.3 (legacy MDT rules)

NOTE: Measurement values related to ERM carriers are logged in Logged MDT report without checking *qualityThreshold* criterion configured in ERM configuration

**Observation 4:** Explicit indication of theearly measurements/idle mode configuration relevance for logged measurement purposes (i.e. flag) implies the need to apply new measurement performance principles into Logged MDT measurement logging.

**Observation 5:** Implicit indication of the early measurements/idle mode configuration relevance for logged measurement purposes (by list of frequencies) enables avoidance of the new (ERM) measurement performance principles into Logged MDT measurement logging.

**Question 1**: Which Option do companies support for extending Logged MDT with early measurements logging?

Option 1: Explicit flag: EMR configuration and EMR measurement performance on top of extended Logged MDT

Option 2: Explicit flag, but either EMR configuration and EMR measurement performance or extended Logged MDT with MDT measurement performance.

Option 3: Implicit EMR configuration by extended Logged MDT by AreaConfig and/or InterFreqTargetInfo with MDT measurement performance (report quantity, quality threshold, etc. for ERM do not apply)

|  |
| --- |
| Answers to Question 1 |
| Company | Option 1 Yes/No | Option 2Yes/No | Option 3Yes/No | Technical Arguments  |
| ZTE | NO | NO | Yes | We believe both option1 and option 2 doesn’t align with MDT principles. In our understanding the intention it to allow logging on early measurement frequencies (i.e., not just on frequencies for cell (re)selection) And we prefer to decouple the logged MDT from EMR. |
| OPPO | YesYES | Yes |  | The intention of introducing EMR is only for fast SN addition. The network maybe reluctant to know the coverage of the EMR targeting frequencies/cells coverage. If the network does not want the EMR logged measurement results, the UE should not log and report them, for the sake of saving the air-interface resource and power consumption. |
| Nokia | No | No | Yes | We believe extended Logged MDT by new configuration possibilities (i.e.*AreaConfig* and/or *InterFreqTargetInfo*) with logging principles following regular performance requirements (as it used to be in Logged MDT) is sufficient enhancement. |
| Qualcomm | Yes | No | No | In my understanding, the EMR is configured for a low duration (remains valid in a validity area) while logged MDT logging duration in general can be significantly larger than EMR. In most of the scenario, the network cannot pre-determined (before configuring the logged MDT) which frequency and area will remain valid for EMR. To accurately configure the area and carrier frequency the network needs to know the UE mobility speed and patter accurately, which may not be determined with high accuracy. When UE perform the EMR, UE logs the measurements in the logged measurement report if the requested by network by setting the flag. Therefore, option 1 seems the best solution. |
| Samsung | No | No | Yes with some modification | We see no real need for per UE control for storing results of nonSIB frequencies i.e. network already has the option to use per UE control for performing EMR measurements and that seems sufficient. Rather than per UE control, it would be good to introduce a flag in SI indicating network support for handling nonSIB frequencies i.e. UE reports results of nonSIB frequencies only if the flag is set. Note that we understand that network should be able to include a nonSIB frequency in the field defining the target frequencies that is in the LogMDT configuration. |
| CATT | Yes | No strong view | No | Option 1 seems to be a simpler way to achieve the purpose of logging early measurements results in logged MDT report. Both option 2 and option 3 need the network to set the frequencies for non-cellReselection frequencies in *AreaConfig* and/or *InterFreqTargetInf* which increases the complexity. |
| Ericsson | Please see comments | Please see comments | Please see comments | **From the configuration point of view:** Option-1 is the simplistic approach and works well in most of the cases. However, **we would like to ask whether the option-1 explicitly excludes the possibility to configure the non reselection frequencies in the ‘*InterFreqTargetInfo*’?** If that is the case, then we do not want agree with option-1 because, the OAM might be interested in building the coverage map of only freq-X which is a non-cell reselection frequency but the number of carriers configured for the early measurements might be many. Thus we should allow for the configuration flexibility i.e., a combination of option-1 + option-3.Option-3 is configuration friendly but has the problem that the OAM must configure the ‘***InterFreqTargetInfo*’**’ which is okay when one wants to build the coverage map of a newly deployed frequency but is very inefficient when the OAM node wants to build coverage map for all the non reselection frequencies. If option-3 is choses, **we would like to know if we could expand the option-3 to include the possibility of logging EMR frequency measurements when the OAM has not configured the ‘*InterFreqTargetInfo*’?** Thus, it seems like a combination of option-1 + option-3 is most useful i.e., 1. The UE can be configured with a flag to indicate whether EMR frequencies should be logged in MDT report
	1. If this flag is present, then the UE is allowed to log EMR frequencies in logged MDT report
	2. If this flag is absent, then the UE is not allowed to log EMR frequencies in logged MDT report
2. If the UE is configured with ***InterFreqTargetInfo*** then the UE performs logging of measurements only on these frequencies.
	1. If the OAM has configured the flag in 1) then the OAM is allowed to configure EMR frequencies in ***InterFreqTargetInfo*’** otherwise it is forbidden (implementation can take care of such requirement)
3. If the UE is **not** configured with ***InterFreqTargetInfo*** then the UE performs logging of measurements on:
	1. If the flag in 1) is set then the UE logs meaurements for EMR + reselection frequencies.
	2. If the flag in 1) is not set then the UE logs meaurements for reselection frequencies only.

**From the reporting point of view:**From reporting point of view, we see large benefits of ignoring the *qualityThreshold* at the time of logging measurements concerning the EMR frequencies. This is because the MDT results are used for coverage map build up purposes whereas the *qualityThreshold* is used to keep sufficiently high bar for setting up a DC or a CA configuration based on Idle/Inactive measurements. Thus *qualityThreshold* should not be applicable for the measurements logged in MDT report associated to EMR frequencies. |
| Huawei, HiSilicon | Yes | No | No | We also need to consider the case that the idle measurement is configured during the logged MDT measurement. For example, the network configures the logged MDT measurement. The UE enters the RRC\_IDLE without the early measurement. After a while, the UE enters the RRC\_CONNECTED in another cell. The new cell configures the early measurement for the UE and the logged MDT measurement is still valid. In this case, we think the UE also need to log the early measurement results.In option 1, for the sentence “Detailed configuration parameters of the idle measurement configuration (report quantity, quality threshold, etc) for EMR purpose”, our understanding is that the UE will extend the logged frequencies to include the frequencies in the early measurement. For the logged MDT report, the UE does not need to consider the report quantity, quality threshold in the early measurement.  |
| Intel | Yes | No | No | We also share the same view that option 1 seems like the simplest way. We can also consider option 3 as in addition. |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Summary 1**: 9 companies responded with the following views split:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Option 1 | Option 2 | Option 3 |
| Companies votes | Yes: 5/9Conditionally Yes: 1/9 | Yes: 1/9 | Yes: 2/9Conditionally Yes: 2/9 |

**Proposal 1**: Extended LoggedMeasurementConfiguration with *AreaConfig* and/or *InterFreqTargetInfo*, implies the Logged MDT reports are provided according to legacy MDT performance measurements.

**Proposal 2:** LoggedMeasurementConfiguration is extended with a flag to indicate if an early measurement/idle mode configuration has relevance for logged measurement purposes.

**Proposal 3**: FFS how the flag impacts Logged MDT reporting.

### 3.2 Frequency-specific and RAT-specific coverage hole indication in logged MDT report and its associated configuration

Based on the email discussion (in [R2-2108965](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108965.zip) Report of [Offline-872][SONMDT] Logged MDT enhancements (Ericsson)), RAN2#115-e identified that Logged MDT enhancement regarding RAT-specific and frequency-specific coverage hole, can be potentially worth considering topics for Rel-17 enhancements.

Original proposals for the enhancements were contributed in [R2-2107394](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107394.zip)/[R2-2105625](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105625.zip) and [R2-2108331](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108331.zip)/ [R2-2106037](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106037.zip).

The need for addressing RAT-specific coverage hole is motivated by the observations:

[R2-2107394](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107394.zip) **Observation:** According to the R16 TS 38.331 and TS 38.304, 5G coverage hole could not trigger UE in RRC\_IDLE state to log radio measurement results. Instead, only when the UE cannot find any suitable cell on all RATs, the *outofCoverage* event can be triggered to log the radio measurement results of the UE.

[R2-2108331](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108331.zip) **Observation:** Current *eventTriggered* measurement *OutofService* cannot address the issue of RAT-specific and frequency-specific coverage holes, as this is triggered only when UE cannot find any suitable cell to camp irrespective of the RAT. Similarly, current *eventTriggered* measurement *OutofService* cannot address the issue of frequency-specific coverage hole, where suitable cells operating on a given frequency or a list of frequencies may not be present.

The corresponding solutions consider following **implications**:

**Option 1:**Introduction of ***new eventType*** into existing*L*o*ggedEventTriggerConfig* IE in the logged MDT configuration for logging RAT-specific coverage hole ([R2-2105625](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105625.zip)).

The related [R2-2107394](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107394.zip)/[R2-2105625](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105625.zip) also clarifies when the current serving cell radio measurement is good, according to the cell reselection principle, the UE only needs to perform radio measurements on the carrier frequencies with higher reselection priority.

Hence assume that cell reselection criteria when Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ (TS38.304) is too limiting, thus it might imply a need for further changes.

**Option 2:** Introduction of RAT-specific *evenTriggered* measurements logging to detect RAT-specific coverage holes when UE cannot find a suitable cell to camp on a given RAT ([R2-2108331](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108331.zip))

**Option 3:** Introduce frequency-specific *eventTriggered* measurements logging ([R2-2108331](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108331.zip))

**Option 4:** UE can be configured with two logged measurement configurations, one over LTE and another over NR, without SN configuration. LTE and NR logged MDT configurations are independent, and UE performs logging based on the logged MDT configuration of the same RAT its camps ([R2-2106037](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106037.zip)).

**Question 2**: For extending Logged MDT configuration and reporting in Rel-17, which of the four options do companies support?

|  |
| --- |
| Answers to Question 2 |
| Company | Option 1 Yes/No | Option 2Yes/No | Option 3Yes/No | Option 4Yes/No | Technical Arguments |
| ZTE |  |  |  |  | Before discussion possible options we shall first confirm the necessity of introducing RAT-specific or frequency-specific coverage hole. |
| OPPO |  | Yes | Yes | No | In the current R16 specification, ***outOfCoverage*** and the corresponding measurement results being recorded in the logged MDT report could only be triggered when UE enters ‘any cell selection state’, in which UE cannot find any suitable cell on both 4G and 5G. However, considering the wide deployment of 4G network, such event occurs rarely, which leads to difficult identification of the 5G coverage hole by the logged MDT technique. Bearing this in mind, we are concerned that UE data experience could be in danger if the 5G coverage cannot be identified properly. Some may argue that back in R16, the InterFreqTargetInfo IE introduced in the araConfiguration could be used for such purposes—setting the InterFreqTargetInfo to 5G frequencies. However, we should note that such implementation has two problems:1. It is configured for periodic logged measurement reporting. UE needs to log and report measurement periodically, we think the overhead (both storing and reporting the measurement results) is large if the purpose is only for identifying the coverage hole for the specific frequencies. 2. With such periodic measurement results reporting, the network OAM should do a lot of work for filtering out the UE reported result---to identify which set of cells does not meet the criteria of serving as a suitable cell by investigating the measurement results. Also it should be noted that the Option 4 is irrelevant with the issue presented in this section. Moreover, according to the paper of [R2-2106037](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106037.zip) and R2-2107394, no difference between Option 1 and Option2&3 is found. |
| Nokia |  |  |  |  | Agree with ZTE |
| Qualcomm |  |  |  |  | We can discuss further the need for RAT and frequency-specific coverage hole. However, I believe that OPPO have nicely summarized the need for RAT and frequency specific coverage hole detection. Current event-trigged measurements logging is not sufficient for the detection of RAT or frequency specific coverage hole, as discussed by OPPO above. Though, we do not prefer to introduce any additional measurements for the detection and logging of RAT and frequency coverage holes. |
| Samsung |  |  |  |  | We also do not see a need for addressing RAT-/frequency-specific coverage hole i.e. its necessity should be confirmed first. |
| CATT |  |  |  |  | Agree with ZTE, we need to discuss whether to introduce RAT-specific or frequency-specific coverage hole firstly. |
| Ericsson |  |  |  |  | We believe that the UE is aware of a coverage hole in a neighboring frequency when it performs measurements in Idle/Inactive based on RAN4 requirements and cell reselection principle. For example, a UE always attempts to camp in the highest priority frequency when available. If such a frequency is not available, then the UE camps on the second best frequency. However, in the MDT logs, there is no indication that the UE was unable to find the highest priority frequency(ies). Such an indication would help the operator to identify the coverage holes much quickly!The same applies for higher priority RATs as well.**We do not think there is a need to introduce a new ‘event’ for these in the logged MDT configuration. This can just be a MDT report enhancement wherein the UE indicates if it has detected a coverage hole in a frequency where it has performed measurement and not found any suitable cells.** |
| Huawei, HiSilicon | Yes | No | No | No | In our understanding, the use case of logging RAT-specific coverage hole is that 5G coverage is weak but 4G coverage is good, so it is useful for the UE to log the 5G coverage hole and report it to the network. |
| Intel |  |  |  |  | Agree with ZTE |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Summary 2**:

9 companies responded, out of which 7 doubt in motivation to introduce the new configuration events for RAT or frequency-specific configuration events.**Proposal 4**: Frequency-specific and RAT-specific coverage hole indication in logged MDT are not pursued in Rel-17.

### 3.3 Enhancements associated to CEF report and RLF report for UL/DL coverage imbalance issues

Based on the email discussion in RAN2#113bis-e reported in [R2-2104536](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104536.zip), UL/DL coverage imbalance issue could not be concluded:

UL/DL coverage imbalance

Proposal 13A: FFS how to identify and solve the problem about UL/DL coverage imbalance.

Further, based on the email discussion (in [R2-2108965](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108965.zip) Report of [Offline-872][SONMDT] Logged MDT enhancements (Ericsson)), RAN2#115-e acknowledged that CEF report and/or RLF report enhancement due to UL/DL coverage imbalance issues, can be still potentially worth considering topic for Rel-17 enhancements.

Original proposals for the enhancements were contributed in [R2-2107508](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107508.zip)/[R2-2100602](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100602.zip) and [R2-2108543](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108543.zip).

The way of addressing UL/DL coverage imbalance issue is motivated with the following observations:

[R2-2100602](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100602.zip) **Observation:** The current parameters in RLF and CEF reports have shortages and do not allow to identify DL connection quality in case of RLF triggered by UL coverage problems.If measResultNeigCells-r16 does not contain a measurement of RLF’s *failedPCellId-r16* (last serving cell), it is not clear if and when DL coverage faded away during UL outage. The IE *noSuitableCellFound* in the RLF report indicates a DL coverage issue during re-establishment phase (T311). It is very unlikely that this IE is set “true” in combination with connectionFailureType: *rlc-MaxNumRetx*, and DL coverage issue can be seen as coherent with UL coverage issue. i.e. RLF will be treated as DL coverage issue.

[R2-2108543](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108543.zip) **Observation:** For Rel-16 CEF Report, the information of other attempted but failed cells rather than the last one is missing, and the coverage issue of these cells may not be identified.

[R2-2108648](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108648.zip) **Observation:** With current reporting mechanisms, it seems sufficient to identify DL coverage. However, it is insufficient to estimate UL coverage. To identify UL/DL coverage imbalanced, the UL coverage can be estimated with the following conditions:

* Max UE power is higher than P\_max or
* P\_compensation in S-criteria is not equal to zero

These conditions are related to UL availability. UE can evaluate the condition after RLF, and include a simple indicator in RLF Report, whenever the conditions have met.

The corresponding proposals consider the following **implications**:

**Option 1:** To record DL signal state during an UL outage, RLF report is extended with “DL quality” information.

The field setting is assumed to be determined based on events around RLF (e.g. detecting a suitable cell, RRC Re-establishment attempt failure, losing cell signal).

**Option 2:** For the scenario that UE experienced multiple CEF in the same cell, UE could just keep one CEF Report for the cell, especially when locations of multiple CEF are quite near, or the time elapsed between the consecutive CEFs is short.

**Option 3:** UL coverage can be estimated with the following conditions:

* Max UE power is higher than P\_max or
* P\_compensation in S-criteria is not equal to zero

**Question 3**: To which of the Options do you agree to address UL/DL coverage imbalance issue?

|  |
| --- |
| Answers to Question 3 |
| Company | Option 1 Yes/No | Option 2Yes/No | Option 3Yes/No | Technical Arguments |
| ZTE | No | No | Can be further discussed | Not sure how option 1 and option 2 can be used to address the DL/UL imbalance issue. The DL quality can be derived based on the measurements included in RLF while option 2 is existing bebavior right? Currently only the latest CEF is stored. High power level could be a result of bad UL coverage, but still it is also impacted by other factors, thus it is suggested to further discuss it.  |
| OPPO |  | Yes |  | Agree with ZTE for the option 1, further clarification should be made. In the current specification, the section of 5.3.10.5 RLF report content determination includes the recording of the DL measurement results as follows:1> set the *measResultLastServCell* to include the cell level RSRP, RSRQ and the available SINR, of the source PCell(in case HO failure) or PCell (in case RLF) based on the available SSB and CSI-RS measurements collected up to the moment the UE detected failure;For the second option, we think it is proposed to store more than one CEF report. In addition, to avoid redundant CEF storing overhead, the UE should just keep one CEF Report for the cell, especially when locations of multiple CEF are quite near, or the time elapsed between the consecutive CEFs is short.  |
| Nokia | Yes | No  | No | Option 1: UE analysis after RLF triggered by “maximum number of RLC retransmissions” how DL connectivity was during UL outage. As long as UE tries to re-connect, there is DL connectivity. UE realized when DL signal also fades away, and this can be recorded in RLF report. UE has the best view and all information proposed in Options 2 and 3, are not providing such details that network is able to reconstruct the situation the UE experienced.Option 2: This proposal helps to reduce redundant information of CEF reports, but is not conducive to solve problem in terms of getting information about the DL availability after UL caused RLF. The missing CE attempts (i.e. missing CEFs) would be actually relevant, i.e. when DL vanishes and UE stops trying.Option 3: The proposed IEs are already existing in CEF Report, e.g. maxTxPowerReached (since Rel 11), but are irrelevant for the addressed problem, namely the DL availability after/during UL-related RLF. The CEF as such already tells us that DL is available, since without measuring a DL signal a RACH and connection setup attempt would haved. The proposed conditions provide information about UL, but not about DL is dealing with UL coverage |
| Qualcomm | Yes | No | No | Our preference is option 1, where UE can record DL signal state during UL outage. This provides network with sufficient required information without consuming unnecessary UE memory. |
| Samsung | No | No | Yes | Regarding the option 1, with current reporting mechanisms, it seems sufficient to identify DL coverage. Since it is enough to estimate UL coverage, the UL coverage should be identified in order to identify UL/DL coverage imbalanced.Regarding the option 2, the networks have already collected not a few CEF reports from multiple UEs, e.g. located in the cell boundary. It’s unclear why it’s a potential solution to allow a UE to log multiple CEF reports. This approach is just to increase the additional burden to a UE. |
| CATT | No | Yes | No | A list of CEF reports can assist the network to identify the UL/DL coverage imbalance compared with the CEF number used in R16. For option 2, we think it is proposed to store multiple CEF reports except for the scenario that UE experienced multiple CEF in the same cell especially when locations of multiple CEF are quite near, or the time elapsed between the consecutive CEFs is short. This mainly considers the memory occupation problem. According to the above analysis, we think that option 2 is an optimization and enhancement of R16 CEF report, which is fine to us. |
| Ericsson | No | No | May be(needs further clarification) | **Option-1 related comments**As of today, the UE logs the measurements of the serving cells and neighbour cells at the time of declaring RLF. This also includes the beam level measurements. These are Layer-3 filtered measurements and should reflect the stable measurement as observed. This should be sufficient for the network to know whether the UE has a DL coverage at the location of declaring failure. Further, introducing something like *“downlink disappeared”* is redundant as the presence of SSB/CSIRS measurements should indicate whether there was DL coverage at that location or not. If YES, then it is an indication of improper RLM configuration. If NOT, then it is a DL coverage hole.So, we do not see the solution in option-1 adding any additional valuable information. Thus, we do not support it. **Option-2 related comments**In our understanding, option-2 is too complex to configure as ‘closeness’ in geographical terms could be very different from ‘closeness’ in radio terms and thus it might complicate the UE behaviour in idle/inactive state.**Option-3 related comments**This can be further discussed as we are not sure what the OAM can do with this information as different power class UEs will have different UL coverage at the cell boundary and this is already known to the network. |
| Huawei, HiSilicon | No | Yes | No | In our understanding, the current RLF report can include the DL quantity of the previous Pcell, and the CEF report can include the DL quantity of the failed cell. The only missing case is that the UE can only log the last CEF but actually there are multiple CEF.The “Max UE power is higher than P\_max” may be caused by the issue of DL coverage, therefore it may not reflect the UL coverage problem. |
| Intel | Yes | No  | No | For option 1, DL signal reporting should allow the network to know where the imbalance issue is.  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Summary 3**:9 companies responded with the following views split:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Option 1 | Option 2 | Option 3 |
| Companies votes | Yes: 3/9 | Yes: 3/9 | Yes: 1/9Can be further discussed: 2/9 |

Based on the discussion it appears there is no consensus on which solution could address UL/DL coverage imbalance issue. It has been observed that Option 1 and Option 2 would require extension to RLFreport and CEFreport respectively, while Option 3 (deduction based on Max UE power is higher than P\_max or P\_compensation in S-criteria is not equal to zero) would require further understanding on the report extensions and the reports analysis implications (in OAM).

**Proposal 5**: RAN2 to decide if UL coverage estimate based on “Max UE power is higher than P\_max” or “P\_compensation in S-criteria is not equal to zero” is a valid option to solve the problem about UL/DL coverage imbalance.

**Proposal 6**: FFS which option is selected to solve the problem about UL/DL coverage imbalance: “DL signal state during UL outage” or multiple CEF reports.

NOTE: If proposal 5 is agreed, Proposal 6 is extended with the third alternative

# 4 Conclusion

**Proposal 1**: Extended LoggedMeasurementConfiguration with *AreaConfig* and/or *InterFreqTargetInfo*, implies the Logged MDT reports are provided according to legacy MDT performance measurements.

**Proposal 2:** LoggedMeasurementConfiguration is extended with a flag to indicate if an early measurement/idle mode configuration has relevance for logged measurement purposes.

**Proposal 3**: FFS how the flag impacts Logged MDT reporting.

**Proposal 4**: Frequency-specific and RAT-specific coverage hole indication in logged MDT are not pursued in Rel-17.

**Proposal 5**: RAN2 to decide if UL coverage estimate based on “Max UE power is higher than P\_max” or “P\_compensation in S-criteria is not equal to zero” is a valid option to solve the problem about UL/DL coverage imbalance.

**Proposal 6**: FFS which option is selected to solve the problem about UL/DL coverage imbalance: “DL signal state during UL outage” or multiple CEF reports.

NOTE: If proposal 5 is acknowledged , Proposal 6 is extended with the third alternative

# Annex A

Excerpts from Rel-16 TS38.331 on ERM configuration

#### – *VarMeasIdleConfig*

The UE variable *VarMeasIdleConfig* includes the configuration of the measurements to be performed by the UE while in RRC\_IDLE or RRC\_INACTIVE for NR inter-frequency and inter-RAT (i.e. EUTRA) measurements.

*VarMeasIdleConfig UE* variable

-- ASN1START

-- TAG-VARMEASIDLECONFIG-START

VarMeasIdleConfig-r16 ::= SEQUENCE {

 measIdleCarrierListNR-r16 SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierNR-r16 OPTIONAL,

 measIdleCarrierListEUTRA-r16 SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierEUTRA-r16 OPTIONAL,

 measIdleDuration-r16 ENUMERATED {sec10, sec30, sec60, sec120, sec180, sec240, sec300, spare},

 validityAreaList-r16 ValidityAreaList-r16 OPTIONAL

}

-- TAG-VARMEASIDLECONFIG-STOP

-- ASN1STOP

MeasIdleCarrierNR-r16 ::= SEQUENCE {

 carrierFreq-r16 ARFCN-ValueNR,

 ssbSubcarrierSpacing-r16 SubcarrierSpacing,

 frequencyBandList MultiFrequencyBandListNR OPTIONAL, -- Need R

 measCellListNR-r16 CellListNR-r16 OPTIONAL, -- Need R

 reportQuantities-r16 ENUMERATED {rsrp, rsrq, both},

 qualityThreshold-r16 SEQUENCE {

 idleRSRP-Threshold-NR-r16 RSRP-Range OPTIONAL, -- Need R

 idleRSRQ-Threshold-NR-r16 RSRQ-Range OPTIONAL -- Need R

 } OPTIONAL, -- Need R

 ssb-MeasConfig-r16 SEQUENCE {

 nrofSS-BlocksToAverage-r16 INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL, -- Need S

 absThreshSS-BlocksConsolidation-r16 ThresholdNR OPTIONAL, -- Need S

 smtc-r16 SSB-MTC OPTIONAL, -- Need S

 ssb-ToMeasure-r16 SSB-ToMeasure OPTIONAL, -- Need S

 deriveSSB-IndexFromCell-r16 BOOLEAN,

 ss-RSSI-Measurement-r16 SS-RSSI-Measurement OPTIONAL -- Need S

 } OPTIONAL, -- Need S

 beamMeasConfigIdle-r16 BeamMeasConfigIdle-NR-r16 OPTIONAL, -- Need R

 ...

}

Excerpt from Rel-16 TS38.331 on ERM measurement performance 5.7.8.2a:

|  |
| --- |
| While in RRC\_IDLE or RRC\_INACTIVE, and T331 is running, the UE shall:1> perform the measurements in accordance with the following:2> if the *VarMeasIdleConfig* includes the *measIdleCarrierListEUTRA* and the *SIB1* contains *idleModeMeasurementsEUTRA*:3> for each entry in *measIdleCarrierListEUTRA* within *VarMeasIdleConfig*:(…)5> perform measurements in the carrier frequency and bandwidth indicated by *carrierFreqEUTRA* and *allowedMeasBandwidth* within the corresponding entry;(…)5> if the *measCellListEUTRA* is included:6> consider cells identified by each entry within the *measCellListEUTRA* to be applicable for idle/inactive mode measurement reporting;5> else:6> consider up to *maxCellMeasIdle* strongest identified cells, according to the sorting quantity, to be applicable for idle/inactive measurement reporting;5> for all cells applicable for idle/inactive measurement reporting, derive measurement results for the measurement quantities indicated by *reportQuantitiesEUTRA;*5> store the derived measurement results as indicated by *reportQuantitiesEUTRA* within the *measReportIdleEUTRA* in *VarMeasIdleReport* in decreasing order of the sorting quantity, i.e. the best cell is included first, as follows:(…)2> if the *VarMeasIdleConfig* includes the *measIdleCarrierListNR* and the SIB1 contains *idleModeMeasurementsNR*:3> for each entry in *measIdleCarrierListNR* within *VarMeasIdleConfig* that contains *ssb-MeasConfig*:(…)5> store the derived cell measurement results as indicated by *reportQuantities* for cells applicable for idle/inactive measurement reporting within *measResultsPerCarrierListIdleNR* in the *measReportIdleNR* in *VarMeasIdleReport* in decreasing order of the cell sorting quantity, i.e. the best cell is included first, as follows:(…)NOTE 1: How the UE performs idle/inactive measurements is up to UE implementation as long as the requirements in TS 38.133 [14] are met for measurement reporting.NOTE 2: The UE is not required to perform idle/inactive measurements on a given carrier if the SSB configuration of that carrier provided via dedicated signaling is different from the SSB configuration broadcasted in the serving cell, if any.NOTE 3: How the UE prioritizes which frequencies to measure or report (in case it is configured with more frequencies than it can measure or report) is left to UE implementation. |

Excerpt from Rel-16 TS38.331 on MDT measurement performance 5.5a.3 (legacy MDT rules):

|  |
| --- |
| (….)if *areaConfiguration* is not included in *VarLogMeasConfig* or if the current camping cell is part of the area indicated by *areaConfig* of *areaConfiguration* in *VarLogMeasConfig*:(…)3> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell re-selection, to include measurements of neighbouring cell that became available during the last logging interval and according to the following:4> include measurement results for at most 6 neighbouring cells on the NR serving frequency and for at most 3 cells per NR neighbouring frequency and for the NR neighbouring frequencies in accordance with the following:5> if *interFreqTargetInfo* is included in *VarLogMeasConfig*:6> include measurement results for NR neighbouring frequencies that are included in both *interFreqTargetInfo* and *SIB4*;5> else:6> include measurement results for NR neighbouring frequencies that are included in *SIB4*;4> include measurement results for at most 3 neighbours per inter-RAT frequency that is included in *SIB5*;4> for each neighbour cell included, include the optional fields that are available;NOTE: The UE includes the latest results of the available measurements as used for cell reselection evaluation in RRC\_IDLE or RRC\_INACTIVE, which are performed in accordance with the performance requirements as specified in TS 38.133 [14]. |

# Annex B

# RAN2 agreements on Logged MDT enhancements

####  RAN2#115-e

R2-2108965 Report of [Offline-872][SONMDT] Logged MDT enhancements (Ericsson)

Agreements:

1 The UE includes the beam identifiers used to acquire the SI message(s) in the on-demand SI procedure related report. FFS: How to capture this information

2 Extend RA report for both successful and failure on-demand SI request. FFS: Whether successful one-demand SI request related scenario is included or not is postponed to RAN2#116 meeting.

3 Signaling based logged MDT override protection is applicable in the following scenarios:

1) Signaling based Logged MDT is configured, but no results are available e.g. so far nothing stored, or all previously stored results retrieved

2) Signaling based Logged MDT configuration is stopped (i.e. the expiry of T330), but UE still has un-retrieved results that would be discarded upon accepting a new configuration

4 Include an indicator to indicate the signaling based logged MDT configuration availability in RRCSetupComplete / RRCConnectionSetupComplete and RRCResumeComplete / RRCConnectionResumeComplete.

 FFS: Implicit (flag indicating T330 is running or not) vs explicit indication

5 UE includes an indication regarding whether the T330 timer is running or not in RRCSetupComplete / RRCConnectionSetupComplete and RRCResumeComplete / RRCConnectionResumeComplete.

Proposal 1 The scenario of logging of measurements associated to on-demand SI request upon on-demand positioning SI/SIB request and upon on-demand SI request in connected mode are not pursued in Rel-17.

Proposal 2 The scenario of logging of measurements associated to successful on-demand SI request procedure is postponed to the next RAN2 meeting.

Proposal 4 The following measurements aer not included in the on-demand SI related report.

1. The number of times each SIB was intended to be requested by the UE

2. Failure type (failure at RA procedure or failure at acquiring SI messages)

3. The time between consecutive SI requests

4. The location information at the time of performing the SI request

5. An indicator to indicate if the SI request was performed over NUL or SUL

Proposal 5 Decision on inclusion of an indicator in the on-demand SI request related report indicating whether the on-demand SI request was successful or not is postponed to next RAN2 meeting.

Proposal 8 The following scenarios associated to Signaling based logged MDT override protection are postponed to RAN2#116 meeting:

1) Signaling based logged MDT is configured in LTE (NR), the UE comes to connected in NR (LTE)

2) Signaling based logged MDT is configured, the UE comes to connected in a PLMN that is not in the plmn-IdentityList.

Proposal 11 Rel-16 RAN2 specifications are unchanged with respect to RAN3’s question on the presence of interFreqTargetList within AreaConfiguration.

Proposal 12 RAN2 works on the introduction of AreaConfiguration-r17 (including areaConfig-r16 and interFreqTargetList-r16 inside it with both fields being optional) in Rel-17.

Proposal 13 RAN2 confirms that frequency band list configuration is not supported in interFreqTargetList configuration.

Proposal 14 RAN2 postpones the discussions on the following to RAN2#116 meeting:

1) Clarifications related to early measurements logging in logged MDT report

2) Frequency-specific and RAT-specific coverage hole indication in logged MDT report and its associated configuration

3) Enhancements associated to CEF report and RLF report for UL/DL coverage imbalance issues

Proposal 15 RAN2 to further discuss whether MDT for logging slice availability is considered in Rel-17.

####  RAN2#114-e

R2-2106482 Summary on agenda item 8.13.3.2 Logged MDT enhancements Huawei

Agreements:

1 For the content for on demand SI:

 Include information to differentiate between Msg1-based or Msg3-based on-demand SI request. How to convey the information is FFS.

 UE records intended SIBs for failed on-Demand SI request. FFS the successful case.

R2-2106678 Summary of [AT114e][802][SON/MDT] Reporting on demand SI related information (CATT)‎ CATT

=> Noted

Agreements:

1 In order to avoid overwriting of signalling-based logged MDT, UE-assisted and network-based solution, which relying on network implementation through UE providing assistance, is introduced.

Two alternatives:

- UE-based solution, which is UE rejects network configuration

- UE-assisted and network-based solution, which relying on network implementation through UE providing assistance

####  RAN2#113b-e

[R2-2104434](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104434.zip) Report of [AT113b-e][804][NR/R17 SON/MDT] Logged MDT (CMCC) CMCC

Agreements:

1 UE reports the SIBs that UE actually intends to request.

2 Both Msg1-based and Msg3-based SI request related information are supported.

3 Option 3 ([R2-2104434](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104434.zip)) is used for logged MDT in EN-DC, i.e., do not introduce SN configuration for logged MDT (neither for camping nor for non-camping/ EMR specific frequencies).

4 UE provides assistance by which network can avoid overwriting of an MDT configuration.

5 Introduce the logged MDT type (i.e. the management based MDT or the signalling based MDT) in the logged MDT configuration.

Proposal 4: It is FFS whether to extend current RA-report to include the on demand SI related information.

Proposal 6: It is FFS whether there is a need to avoid logged MDT configuration in the following cases from network perspective:

1) Logged MDT is configured, but no results are available e.g. so far nothing stored, or all previously stored results retrieved

2) Logged MDT configuration is released, but UE still has un-retrieved results that would be discarded upon accepting a new configuration

####  RAN2#113-e

[R2-2102143](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2102143.zip) Report of [AT113-e][844][NR/R17 SON/MDT]  Logged MDT part I Huawei

Agreement:

 The network can use a flag in logged MDT configuration to indicate if an early measurement/idle mode configuration has relevance for logged measurement purposes. Upon such an indication, UE can log measurements on non-cellReselection (carrier frequencies not part of SIB4 or SIB5). AreaConfig and/or InterFreqTargetInfo can be used for filtering of SIB4 and non-SIB4 frequencies. Whether a flag is needed should be FFS.

[R2-2102142](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2102142.zip) Report of [AT113-e][845] [NR/R17 SON/MDT] Logged MDT part II (CMCC) CMCC

=> UE records the on demand SI related information for following scenarios:

 1. Failed on-demand SI request

 2. Successful on-demand SI request

Agreements:

1 One specific raPurpose is introduced for MSG3 based on demand SI request.

All the following proposals can be discussed through post meeting email discussion.

FFS: UE reports its requested notBroadcasting SI message. It is FFS to only report the SIBs UE actually intends to request.

Proposal 2: It is FFS to consider following scenarios:

3. Cell reselection occurs during the RACH for SI request.

4. The required SI is already broadcast periodically by network

5. Detecting geographic areas that are (unintentionally) covered by a non-desired SIA

6. Connected on-demand SI request cases

Proposal 4: It is FFS for UE to report Time elapsed since the SI request initiation or the UE modem realizes the need for on demand SI until the successful SI acquisition or the acquisition failure.

Proposal 6: It is FFS whether only Msg3-based SI request related information is reported.

Proposal 7: It is FFS whether to extend current RA-report to include the on demand SI information.

####  RAN2#112-e

R2-2010897 Report of [AT112-e][804][NR/R17 SON/MDT] MDT enhancements (Huawei)

Agreements:

1 NR MDT support IDC mechanism, including:

 - upon detection of IDC, the UE suppress logging and tag MDT report with InDeviceCoexDetected flag.

 - UE resumes the measurement logging when the IDC problem is resolved

=> RAN2 to investigate logging early measurements.

=> RAN2 to investigate MDT and On-demand SI.

=> Other topics are still open to be pursued.