3GPP TSG-RAN WG2#113-bis-e DocNumber

Electronic meeting, 12th April – 20th April 2021

Agenda Item: 6.10.1

Source: Ericsson

Title: Report of email discussion on Timestamp of event triggered MDT

Document for: Discussion, Decision

# 1 Introduction

This contribution is related to the following email discussion.

* [Post113-e][NR/R16 SON/MDT]  Timestamp of event triggered MDT (Ericsson)

- Focus on the issue “Timestamp of event triggered logged MDT” in R2-2102141.

- Figure out the UE behaviour

 Intended outcome: Report

 Deadline: Next meeting

The intention of this email discussion is to identify the intended UE behavior for the when the UE includes measurements in the event triggered logging of measurements in the logged MDT procedure.

The email discussion will be in two phases. During the first phase, the email discussion will be using the questionnaire in this contribution. In the second phase, companies can check the summary of the outcome of the email discussion (the deadlines are as per the chairman’s guideline wherein March 29th to April 5th is classified as silent period).

 Phase-1:

 Intended outcome: Identification of the UEs expected behaviour for event triggered logged MDT (if any)

 Deadline: Wednesday 24/03/2021 23:59 UTC

 Phase-2:

 Intended outcome: agree on the summary and TP (if any)

 Deadline: Friday 26/03/2021 23:59 UTC

# 2 Contact Information

|  |  |
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# 3 Discussion

In the following, event-L1 is taken as an example for explaining the different understanding of companies.

## 3.1 Event L1 related

During the RAN2#113-e meeting, an offline discussion [1] was held on the topic of time stamp related information inclusion for the event triggered logged MDT. In this email discussion, companies expressed two different understanding of the specification text.

1. **Option-1A: Based on the field description of the event L1**
2. **Option-2A: Based on the procedural text of the event L1**

These options are better explained using the following figures.

L1 threshold

T1

T2

TTT

loggingInterval

T3

T4

Figure : Example scenario associated to the logging of measurements in L1 event based logged MDT

### Option-A1: Based on the field description of the event L1

Specification Reference (TS 38.331) for this option:

| ***eventType***The value outOfCoverage indicates the UE to perform logging of measurements when the UE enters any cell selection state, and the value eventL1 indicates the UE to perform logging of measurements when the triggering condition (similar as event A2 as specified in 5.5.4.3) as configured in the event is met for the camping cell in camped normally state. |
| --- |

The UE logs measurements when the event entering conditions (threshold +TTT condition) are satisfied for the first time and then subsequently at every expiry of ‘*loggingInterval*’ if the event entering condition is satisfied (threshold condition). Based on this understanding of the specification, the UE logs as per Table 1.

|  |  |
| --- | --- |
| First instance of logging measurement | T2 |
| Second instance of logging measurement | T3 |
| Third instance of logging measurement | T4 |

Table 1: Logging of measurements as per option-A1 based understanding of the specification

As listed in the table, the UE logs the first measurement at time=T2 and then subsequently at every *loggingInterval* from that point in time (i.e., at T3, T4). This is as per the UE behaviour for event-A2 in RRC connected mode wherein the procedural text for first transmission of measurement report would trigger the start of periodical timer with the value *reportInterval* associated to the subsequent transmission of measurement report (excerpts from the section 5.5.5.1 is given below).

1> if the *numberOfReportsSent* as defined within the *VarMeasReportList* for this *measId* is less than the *reportAmount* as defined within the corresponding *reportConfig* for this *measId*:

2> start the periodical reporting timer with the value of *reportInterval* as defined within the corresponding *reportConfig* for this *measId*;

Thus, the option-A1 follows the UE behaviour inline with event-A2.

### Option-A2: Based on the procedural text of the event L1

Specification Reference (TS 38.331) for this option:

2> else if the *reportType* is set to *eventTriggered* and *eventType* is set to *eventL1*:

3> if the UE is in camped normally state on an NR cell and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport* and, if the cell is part of the area indicated by *areaConfiguration* if configured in *VarLogMeasConfig*;

4> perform the logging at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the conditions indicated by the *eventL1* are met;

At every expiry of ‘*loggingInterval*’ if the event entering conditions are satisfied (threshold+TTT condition). Based on this understanding of the specification, the UE logs as per Table 2.

|  |  |
| --- | --- |
| First instance of logging measurement | T3 |
| Second instance of logging measurement | T4 |

Table 2: Logging of measurements as per option-A2 based understanding of the specification

As listed in the table, the UE logs the first measurement at time=T3 as this is the first time when the loggingInterval related criterion is fulfilled after meeting the event entering condition. Further on, the UE logs measurements subsequently at every *loggingInterval* from that point in time (i.e., at T4).

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Based on this, the rapporteur would like to request companies to provide their views on what is their current understanding of the UE’s expected behaviour for L1 event.

**Question-1: Which of the following is the expected UE behavior for the event L1 based logging of measurements in logged MDT (please add any new option based on you understanding of the specification)?**

1. **Option-1A: Based on the field description of the event L1**
2. **Option-2A: Based on the procedural text of the event L1**
3. **Option-3A: ??**

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option-1A/Option-2A** | **Comments (if any changes are to be proposed, please include them here)** |
| Ericsson | Option-1A | As the intention of the event-L1 is to reflect the UE behavior of connected mode event-A2 for the idle/inactive UEs in terms of logging of measurements, we believe the option-1A is the correct solution. With the option-2A, the network does not get the required information about when the poor coverage of the serving cell started (the time ‘T2’ in the scenario depicted in Figure 1). Further, there is a risk that the UE does not store any information about the event-L1 if the UE satisfies the event entering conditions (threshold+TTT) but before the first loggingInterval is expired, the event entering condition is no more satisfied. |
| Qualcomm | Option 1B | The event-based logged measurements are fundamentally different from event A2 based reporting, due to the following:1. In A2 measurement, the for the measurement reporting TTT is always check after each reporting. However, in the logged eventL1 or out-of-service measurement logging, the TTT is check only in the beginning and UE keeps logging until event satisfies at a regular interval based on periodicity defined in the event-based logging.
2. Having a similar scheme as event A2 breaks the logged measurement configuration.
3. In the event-based logging, we need to focus when periodic clocking is started. IF we start logging after the TTT, then the logging may be delayed. Therefore, the periodic cycle starts as soon as event happens and start logging once the TTT expires.

For further detail see figure and description below. If we want something like option-1A, then we should remove TTT from loggedMeasurementConfiguration, otherwise it will be confusing. |
| Huawei, HiSilicon | Option-1A | We think the first instance of logging measurement (i.e. at T2) is beneficial for network. |
| Samsung | Up to UE implementation | We have some sympathy with Ericsson i.e. updating the procedure text was probably overlooked and it is clear that Option-1A performs somewhat better. However, we think it is a minor problem. Considering this at this late stage, we think that it can be just left to UE implementation as a compromise.  |
| vivo | Option 1A | In our understanding, both the eventL1 and eventA2 need to wait the period time of TTT before logging. Once A2 was triggered, the measurement was recorded for the first instant, and logging event will not be interrupted until some conditions are met (not to check the entry condition again at the next interval), e.g., the maximum number of reports are transmitted.But for L1, even though the event was triggered at the first instant, UE still needs to check the entry condition upon the expiry of logginginterval timer and start logging at this instant (instead of the first instant). If the entry condition is not met or the memory reserved for the logged measurement information becomes full, UE will record nothing.In summary, there are two differences between Option 1A and 1B：1. whether the measurement at the first triggered instant will be recorded or not.
2. Whether the entry condition should be checked at each interval before logging.

We tend to agree that the intention of event L1 is to help NW to spot the potential coverage issues, therefore the measurement at the very first event-triggered instant should be recorded, which is similar to A2, but the entry condition examination should remain as L1 is (always check, as described in procedure text).  |
| Sharp | Option 1A or up to UE implementation  | We think the logging at T2 is beneficial to provide more information about the coverage. It can also provide information to the network for the risk case mentioned by Ericsson.But we are not sure how serious this issue is. If it is a minor issue as commented by Samsung, we are also fine to leave it upto UE implementation. |
| CATT | Option-1A | The logging at T2 is beneficial as T2 is the first point that meets the logging conditions. It is useful for the network to acquire the coverage situation and discover the potential coverage issues. |
| ITRI | Option-1A | Logging when the event entering condition is met for the first time, i.e. T2 in the scenario depicted in Figure 1, is beneficial. This helps the newrok to retrieve the measurement information at the instance that the poor converage situation starts. |
| ZTE | Option 1A | After some checking we consider it is beneficial for UE to immediately log measurements when entering and leaving the event. Since the later have been captured in the specs, it would be good to have the same behavior for entering condition as well.In our understanding, the reason to introduce TTT is to filter abnormal case where power suddenly drops (e.g., due to obstacles) but then quickly recovers to avoid useless report. For the same reason, TTT is also needed for UE to determine whether to trigger the event logging, but once UE enters the event it is unnecessary to check TTT again. However to avoid misunderstanding, we think it is needed to clarify in the field description the TTT is only applicable to determine whether to enter the logging event, not for decide whether the Event L1 condition is satisfied or not. The suggested changes are included in subclause 5.1. |
| Nokia | Up to UE implementation | Intuitively, for ‘periodical’ trigger the measurements should be reported once interval lexpires. For event-based-trigger the measurements should be reported once event condition is met -> Option 1A is valid.If we have event-based trigger that should be reported periodically, this is internal UE implementation to detect when the even tis met, but still put the result in a periodical manner ->Option 2A is also valid.Furthermore, it remains unclear how the two time instances (event met, periodical timer expires) match other internal UE conditions (e.g. accuracy of GNSS data associated with the event). We share Sharp and Samsung view, that these could be left as UE’s implementation details. We do not think it casues a serious issues in statistical MDT data logging. |

**Rapportuer summary**: To be added later

## 3.2 *OutOfCoverage* event related

The issue captured for the event L1 based event trigged logged MDT is also applicable for the out-of-coverage based event triggered logged MDT as the field description and the procedural text could cause the same interpretation issues explained for event L1. The corresponding figure illustrating this issue is shown in Figure 2. At time = T1, the UE fails to meet the s-criterion (suitability criterion) for any of the cells that are part of the cell reselection process and after 10 more seconds (section 4.2.2.2 in [2]), i.e., at T2, the UE enters the any cell selection state.

S-criterion Threshold

T1

T2

10 sec

loggingInterval

T3

T4

Figure : Example scenario associated to the logging of measurements in *outOfCoverage* based logged MDT

Two different understanding of the specification text for this scenario is given below.

1. **Option-1B: Based on the field description of the *outOfCoverage* event**
2. **Option-2B: Based on the procedural text of the *outOfCoverage* event**

### Option-1B: Based on the field description of the *outOfCoverage*

Field description associated to *outOfCoverage* event

| ***eventType***The value outOfCoverage indicates the UE to perform logging of measurements when the UE enters any cell selection state, and the value eventL1 indicates the UE to perform logging of measurements when the triggering condition (similar as event A2 as specified in 5.5.4.3) as configured in the event is met for the camping cell in camped normally state. |
| --- |

Based on this understanding of the specification, the UE logs as per Table 3.

|  |  |
| --- | --- |
| First instance of logging measurement | T2 |
| Second instance of logging measurement | T3 |
| Third instance of logging measurement | T4 |

Table 3: Logging of measurements as per option-1B based understanding of the specification

### Option-2B: Based on the procedural text of the *outOfCoverage*

Procedural text associated to *outOfCoverage* event

2> else if the *reportType* is set to *eventTriggered*, and *eventType* is set to *outOfCoverage*:

3> perform the logging at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the UE is in any cell selection state;

3> perform the logging immediately upon transitioning from the any cell selection state to the camped normally state;

Based on this understanding of the specification, the UE logs as per Table 4.

|  |  |
| --- | --- |
| First instance of logging measurement | T3 |
| Second instance of logging measurement | T4 |

Table 4: Logging of measurements as per option-2B based understanding of the specification

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Based on this, the rapporteur would like to request companies to provide their views on what is their current understanding of the UE’s expected behaviour for *outOfCoverage* event.

**Question-2: Which of the following is the expected UE behavior for the *outOfCoverage* event based logging of measurements in logged MDT (please add any new option based on you understanding of the specification)?**

1. **Option-1B: Based on the field description of the outOfCoverage event**
2. **Option-2B: Based on the procedural text of the outOfCoverage event**
3. **Option-3B: ??**

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option-1B/Option-2B** | **Comments (if any changes are to be proposed, please include them here)** |
| Ericsson | Option-1B | Similar reasoning as previous question. With the option-2B, the network does not get the required information about when the UE entered the any cell selection state (the time ‘T2’ in the scenario depicted in Figure 2). Further, there is a risk that the UE does not store any information about the outOfCoverage event if the UE satisfies the event entering conditions (enters any cell selection state) but before the first loggingInterval is expired, the UE returns to the camped normally state. |
| Qualcomm | Option-2B | See comment for Q1. |
| Huawei, HiSilicon | Option-1B | We think the first instance of logging measurement (i.e. at T2) is beneficial for network. |
| Samsung | Up to UE implementation | See our comments in Q1. |
| vivo | Option-1B | See comment for Q1. |
| Sharp | Option 1B or upto UE implemenation | Similar comment for Q1. |
| CATT | Option-1B | Similar comment for Q1. |
| ITRI | Option-1B | Similar comment for Q1. |
| ZTE | Option 1B |  |
| Nokia | Up to UE implementation | See comments in Q1. |

**Rapportuer summary**: To be added later



[QC] In general, for any Ax or Bx events, UE reports the measurements when the Time-to-trigger expires and restarts the TTT. In the logged measurements, I understand that there is no need for restarting TTT every time, and UE keeps logging the measurement periodically if the event is valid. If we select option 1-A or 1-B, the significance of TTT in the logged measurements configuration becomes ambiguous. Furthermore, without these the eventTrigger is nothing more than simply the duplication of periodic measurement logging. Therefore, as shown in the figure, checking TTT expiry showed by done (for example, UE shouldn’t log the first measurement as TTT is not expired) otherwise we argue to remove TTT from logged measurement configuration for eventL1 and Event-OutOfServeice.

## 3.3 Specification clarification

Associated to the issues listed in section 3.1 and section 3.2, the rapporteur believes that some corrections can be performed in the RRC specification to avoid any confusion in the future. Associated to this TPs are provided for option-1A+option-1B based understanding in section 5.1 and for option-2A+option-2B based understanding in section 5.2. Companies are requested to check if they are fine with the changes proposed in the TP or not.

**Question-3: Which of the following changes is agreeable?**

1. **Option-1: Changes as captured in section 5.1**
2. **Option-2: Changes as captured in section 5.2**
3. **Option-3: No changes.**

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option-1/Option-2/ Option-3** | **Comments (if any changes are to be proposed, please include them here)** |
| Ericsson | Option-1 | As the changes in section 5.1 captures the procedural text for the UE in a better way, we prefer to have this change included so as to avoid different UE implementations based on different interpretation of the specification. |
| Qualcomm  | Option-2 |  |
| Huawei, HiSilicon | Option-1 | We agree that changes can be considered in setion 5.1, and the wording can be further checked. |
| Samsung | Option 3 | We do not see much need on change of current specification. If necessary, we can capture what is recommended UE behavior in chairman's note i.e. UE should follow Option-A1 and Option-1B. |
| vivo | Option-1 |  |
| Sharp | Option 1 |  |
| CATT | Option-1 |  |
| ITRI | Option-1 |  |
| ZTE | Option 1  | With clarification on the field description for TTT as proposed in annex 5.1 since the TTT here serves differently as specified in eventA2. |
| Nokia | Option 3 | Stage 2 clarifies the principles:- for NR:- periodic measurement trigger is supported, for which the logging interval is configurable. The parameter specifies the periodicity for storing MDT measurement results.- event-based trigger is supported, for which the logging interval is configurable, which determines periodical logging of available data (e.g. time stamp, location information), and the following two types of events are supported:- measurement quantity-based event L1, for which the event threshold, hysteresis, and time to trigger are configurable. If the configured time to trigger is not a multiple of the DRX cycle, then the UE uses the next multiple of DRX cycle duration that is larger than the time to trigger for evaluating the event L1;In combination with stage 3 procedural text and field descriptions we are not convienced that anything is broken. How the first sample is captured in MDT logs, that have anyway statistical nature, is not critical.  |

**Rapportuer summary**: To be added later

# 3 Conclusion

To be added later

# 4 References

1. R2-2102141, Report of [AT113-e][804][NR/R16 SON/MDT] Stage-2 corrections, CMCC, Nokia, RAN2#113-e meeting, Jan-Feb 2021.
2. TS 38.133

# 5 TP for TS 38.331

## 5.1 Option-1A and Option-1B based TP for TS 38.331

5.5a.3.2 Initiation

While T330 is running, the UE shall:

1> perform the logging in accordance with the following:

2> if the *reportType* is set to *periodical* in the *VarLogMeasConfig*:

3> if the UE is in camped normally state on an NR cell and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport:*

4> if areaConfiguration is not included in *VarLogMeasConfig*; or

4> if the serving cell is part of the area indicated by *areaConfig* in *areaConfiguration* in *VarLogMeasConfig*:

5> perform the logging at regular time intervals, as defined by the *loggingInterval* in the *VarLogMeasConfig*;

2> else if the *reportType* is set to *eventTriggered*, and *eventType* is set to *outOfCoverage*:

3> perform the logging upon entering the any cell selection state and from then on at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the UE is in any cell selection state;

3> perform the logging immediately upon transitioning from the any cell selection state to the camped normally state;

2> else if the *reportType* is set to *eventTriggered* and *eventType* is set to *eventL1*:

3> if the UE is in camped normally state on an NR cell and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport:*

4> if *areaConfiguration* is not included in *VarLogMeasConfig*; or

4> if the serving cell is part of the area indicated by *areaConfig* in *areaConfiguration* in *VarLogMeasConfig*;

5> perform the logging upon satisfying the conditions indicated by the *eventL1* and from then on at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the conditions indicated by the *eventL1* are met;

2> when performing the logging:

3> set the *relativeTimeStamp* to indicate the elapsed time since the moment at which the logged measurement configuration was received;

3> if detailed location information became available during the last logging interval, set the content of the *locationInfo* as in 5.3.3.7:

3> if the UE is in any cell selection state (as specified in TS 38.304 [20]):

4> set *anyCellSelectionDetected* to indicate the detection of no suitable or no acceptable cell found;

4> set the *servCellIdentity* to indicate global cell identity of the last logged cell that the UE was camping on;

4> set the *measResultServingCell* to include the quantities of the last logged cell the UE was camping on;

3> else:

4> set the *servCellIdentity* to indicate global cell identity of the cell the UE is camping on;

4> set the *measResultServingCell* to include the quantities of the cell the UE is camping on;

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].

1. when the memory reserved for the logged measurement information becomes full, stop timer T330 and perform the same actions as performed upon expiry of T330, as specified in 5.5a.1.4.

### 6.2.2 Message definitions

– *LoggedMeasurementConfiguration*

**\*/ Partially omitted \*/**

| ***LoggedMeasurementConfiguration* field descriptions** |
| --- |
| ***timeToTrigger***Time during which specific criteria for the event L1 needs to be met in order to enter the corresponding event and start logging. |

## 5.2 Option-2A and Option-2B based TP for TS 38.331

### 6.2.2 Message definitions

– *LoggedMeasurementConfiguration*

The *LoggedMeasurementConfiguration* message is used to perform logging of measurement results while in RRC\_IDLE or RRC\_INACTIVE. It is used to transfer the logged measurement configuration for network performance optimisation.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

1. ***LoggedMeasurementConfiguration message***

-- ASN1START

-- TAG-LOGGEDMEASUREMENTCONFIGURATION-START

LoggedMeasurementConfiguration-r16 ::= SEQUENCE {

 criticalExtensions CHOICE {

 loggedMeasurementConfiguration-r16 LoggedMeasurementConfiguration-r16-IEs,

 criticalExtensionsFuture SEQUENCE {}

 }

}

LoggedMeasurementConfiguration-r16-IEs ::= SEQUENCE {

 traceReference-r16 TraceReference-r16,

 traceRecordingSessionRef-r16 OCTET STRING (SIZE (2)),

 tce-Id-r16 OCTET STRING (SIZE (1)),

 absoluteTimeInfo-r16 AbsoluteTimeInfo-r16,

 areaConfiguration-r16 AreaConfiguration-r16 OPTIONAL, --Need R

 plmn-IdentityList-r16 PLMN-IdentityList2-r16 OPTIONAL, --Need R

 bt-NameList-r16 SetupRelease {BT-NameList-r16} OPTIONAL, --Need M

 wlan-NameList-r16 SetupRelease {WLAN-NameList-r16} OPTIONAL, --Need M

 sensor-NameList-r16 SetupRelease {Sensor-NameList-r16} OPTIONAL, --Need M

 loggingDuration-r16 LoggingDuration-r16,

 reportType CHOICE {

 periodical LoggedPeriodicalReportConfig-r16,

 eventTriggered LoggedEventTriggerConfig-r16,

 ...

 },

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

LoggedPeriodicalReportConfig-r16 ::= SEQUENCE {

 loggingInterval-r16 LoggingInterval-r16,

 ...

 }

LoggedEventTriggerConfig-r16 ::= SEQUENCE {

 eventType-r16 EventType-r16,

 loggingInterval-r16 LoggingInterval-r16,

 ...

}

EventType-r16 ::= CHOICE {

 outOfCoverage NULL,

 eventL1 SEQUENCE {

 l1-Threshold MeasTriggerQuantity,

 hysteresis Hysteresis,

 timeToTrigger TimeToTrigger

 },

 ...

}

-- TAG-LOGGEDMEASUREMENTCONFIGURATION-STOP

-- ASN1STOP

| ***LoggedMeasurementConfiguration* field descriptions** |
| --- |
| ***absoluteTimeInfo***Indicates the absolute time in the current cell. |
| ***areaConfiguration***Used to restrict the area in which the UE performs measurement logging to cells broadcasting either one of the included cell identities or one of the included tracking area codes/ frequencies. |
| ***eventType***The value outOfCoverage indicates the UE to perform logging of measurements at regular time intervals as defined by the *loggingInterval* while the UE is in any cell selection state, and the value eventL1 indicates the UE to perform logging of measurements at regular time intervals as defined by the *loggingInterval* while the triggering condition as configured in the event is met for the camping cell in camped normally state. |
| ***plmn-IdentityList***Indicates a set of PLMNs defining when the UE performs measurement logging as well as the associated status indication and information retrieval i.e. the UE performs these actions when the RPLMN is part of this set of PLMNs. |
| ***tce-Id***Parameter Trace Collection Entity Id: See TS 32.422 [52]. |
| ***traceRecordingSessionRef***Parameter Trace Recording Session Reference: See TS 32.422 [52]. |
| ***reportType***Parameter configures the type of MDT configuration, specifically Periodic MDT conifguraiton or Event Triggerd MDT configuration. |