**3GPP TSG-RAN WG2 Meeting #117 electronic *R2-2203667***

**Online, February, 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** | **0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | On introducing height information reporting in MDT reports [LTE-Height-MDT] |
|  |  |
| ***Source to WG:*** | KDDI, Ericsson, Qualcomm |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | TEI17 |  | ***Date:*** | 14 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | The MDT measurement reports included in NR includes the measurements related to the UE’s height information. This information is included as follows in TS 38.331.Sensor-LocationInfo-r16 ::= SEQUENCE { sensor-MeasurementInformation-r16 OCTET STRING OPTIONAL, sensor-MotionInformation-r16 OCTET STRING OPTIONAL, ...}***sensor-MeasurementInformation***This field provides barometric pressure measurements as *Sensor-MeasurementInformation* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.The UE includes the barometric pressure measurements in the logged MDT reports and immediate MDT reports based on the network configurations. In the case of immediate MDT, the UE obtains the configuration related to the inclusion of barometric pressure measurements in the *otherConfig* whereas for the logged MDT, the UE obtains the configurations related to the inclusion of baromteric pressure measurements in the *loggedMeasurementConfiguration*.The height information so included in the MDT reports aids the operator to build a 3D coverage map of their deployment. Such height related information is missing in the LTE MDT reports.  |
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| ***Summary of change:*** | Uncompensated barometric pressure information logging is added to the logged MDT and immediate MDT reporting in LTE. |
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| ***Consequences if not approved:*** | Height information reporting is not reported by the UE as part of logged or immediate MDT in LTE, thus leading to inability of the operator to build 3D coverage maps. |
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| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 36.331 CR4756TS 36.306 CR1838 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | 5.1.1.1.1, 5.1.1.2,5.1.1.3.3,5.1.4 |
|  |  |
| ***This CR's revision history:*** |  |

/\*Start of first change\*/

##### 5.1.1.1.1 Configuration parameters

The logged measurement configuration consists of:

- configuration of downlink pilot strength measurements logging for (E-)UTRA and NR.

- configuration of MBSFN measurement logging for E-UTRA.

- configuration of the triggering of logging events:

- for (E-)UTRAN only periodic measurement trigger is supported, for which the logging interval is configurable. The parameter specifies the periodicity for storing MDT measurement results. It should be configured in seconds in multiples of the applied IDLE mode DRX, i.e. multiples of 1.28s which is either a factor or multiple of the IDLE mode DRX. The UE behaviour is unspecified when the UE is configured with a DRX cycle larger than the logging interval.

- 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;

- out-of-coverage detection trigger.

NOTE: The logging configuration for event-based and periodical DL pilot strength logged measurements can be configured independently. Only one type of event can be configured to the UE.

- configuration of the logging duration. This configuration parameter defines a timer activated at the moment of configuration, that continues independent of state changes, RAT or RPLMN change. When the timer expires the logging is stopped and the configuration is cleared (except for the parameters that are required for further reporting e.g. network absolute time stamp, trace reference, trace recording session reference and TCE Id).

- network absolute time stamp to be used as a time reference to UE.

- Trace Reference parameter as indicated by the OAM configuration as specified in TS 32.422 [6].

- Trace Recording Session Reference as indicated by the OAM configuration as specified in TS 32.422 [6].

- TCE Id as indicated by the OAM configuration as specified in TS 32.422 [6].

- (optionally) MDT PLMN List, indicating the PLMNs where measurement collection and log reporting is allowed. It is either the Management Based MDT PLMN List or the Signalling Based MDT PLMN List, depending on how the Logged MDT task was initiated (see 5.1.3).

- (optionally) configuration of a logging area. A UE will log measurements as long as it is within the configured logging area. The scope of the logging area may consist of one of:

- a list of up to 32 global cell identities. If this list is configured, the UE will only log measurements when camping in any of these cells

- a list of up to 8 TAs or 8 LAs or 8 RAs. If this list is configured, the UE will only log measurements when camping in any cell belonging to the preconfigured TA/LA/RAs.

- The configured logging area can span PLMNs in the MDT PLMN List. If no area is configured, the UE will log measurements throughout the PLMNs of the MDT PLMN list.

- (optionally) for NR, configuration of a list of neighbouring frequencies and/or cells, indicating the UE to include neighbouring cell's measurements as indicated in the list in the logged MDT report.

- (optionally) for E-UTRA, configuration of target MBSFN area(s) for MBSFN measurement logging. If target MBSFN area(s) is configured, UE applies it in addition to other restrictions such as the logging area. The UE will log measurements as long as it receives MBMS service from an indicated target MBSFN area and is within the configured logging area. The target MBSFN area(s) is defined by a list of up to 8 entries, where each entry indicates a carrier frequency and optionally indicates a specific MBSFN area on a carrier frequency.

- (optionally) configuration of the WLAN access point names, indicating the UE to attempt to obtain WLAN measurements associated to these access points.

- (optionally) configuration of the Bluetooth beacon names, indicating the UE to attempt to obtain Bluetooth measurements associated to these beacons.

- (optionally) for NR, configuration of the sensor names, indicating the UE to attempt to obtain sensor measurements.

- (optionally) for E-UTRA, configuration indicating the UE to attempt to obtain uncompensated barometric pressure measurements.

/\*end of first change\*/

/\*start of second change\*/

#### 5.1.1.2 Measurement collection

In "camped normally" state, a UE shall perform logging as per the logged measurement configuration. This state includes a period between cell selection criteria not being met and UE entering "any cell selection" state, i.e. 10 s for E-UTRA (See TS 36.133 [3]) or 12 s for UTRA (See TS 25.133 [2]) or 10s for NR (See TS 38.133 [16]).

In "any cell selection" state, a UE shall perform logging of available information (i.e. at least indicator 'anyCellSelectionDetected', time stamp, and the available location information). In "camped on any cell" state, the periodic logging stops. However, it should be noted that the duration timer is kept running. When the UE re-enters "camped normally" state and the duration timer has not expired, the periodic logging is restarted based on new DRX and logging resumes automatically (with a leap in time stamp).

When an E-UTRA UE detects an in-device coexistence problem that may affect the logged measurement results, the UE shall stop measurement logging, indicate in the log that an in-device coexistence problem has occurred, and keep the duration timer running. When the in-device coexistence problem is no longer present, and the duration timer has not expired, the logging resumes, with a leap in time stamp.

For E-UTRA MBSFN measurement logging, the UE shall perform MBSFN measurements only when receiving MBMS service, and measurement logging is performed only for logging intervals for which MBSFN measurements are available. The UE shall perform MBSFN measurements and MBSFN measurement logging in both IDLE and CONNECTED modes.

NOTE: the UE is only required to perform MBSFN measurements when receiving MBMS service of the MBSFN area(s) targeted for logging.

For WLAN measurement logging and Bluetooth measurement logging, the UE shall perform WLAN and Bluetooth measurements, respectively, only when indicated in the corresponding configuration. The measurement logging is performed only for logging intervals for which WLAN and Bluetooth measurements are available, respectively.

The measurement quantities for downlink pilot strength measurement logging are fixed and consist of both RSRP and RSRQ for EUTRA, both RSCP and Ec/No for UTRA FDD, P-CCPCH RSCP for UTRA 1.28 Mcps TDD, Rxlev for GERAN, and Pilot Pn Phase and Pilot Strength for CDMA2000 if the serving cell is EUTRAN cell, and both RSRP and RSRQ for NR.

For NR, in addition to the logged measurement quantities of the camped cell, the best beam index (SSB Index) as along with the best beam RSRP/RSRQ are logged as well as the 'number of good beams' (the number of SSBs that are above the configured threshold i.e., *absThreshSS-BlocksConsolidation,* if configured by the network) associated to the cells within the R value range (which is configured by network for cell reselection) of the highest ranked cell as part of the beam level measurements. Sensor measurements are logged if available.

For E-UTRA, uncompensated barometric pressure measurements are logged if available.

The measurement quantities for E-UTRA MBSFN measurement logging are fixed and consist of MBSFN RSRP, MBSFN RSRQ, BLER for signalling and BLER for data per MCH, in addition to the measurement quantities for downlink pilot strength measurements.

The measurement quantities for WLAN measurement logging are fixed and consist of BSSID, SSID, HESSID of WLAN APs. If configured by the network, optionally available RSSI and RTT can be included.

The measurement quantity for Bluetooth measurement logging is fixed and consists of MAC address of Bluetooth beacons. If configured by the network, optionally available RSSI can be included.

UE collects MDT measurements and continues logging according to the logged measurement configuration until UE memory reserved for MDT is full. In this case the UE stops logging, stops the log duration timer and starts the 48 hour timer.

/\*end of second change\*/

/\*start of third change\*/

##### 5.1.1.3.3 Reporting parameters

For downlink pilot strength measurements, the logged measurement report consists of measurement results for the serving cell (the measurement quantity), available UE measurements performed in idle or inactive for intra-frequency/inter-frequency/inter-RAT, time stamp and location information.

For E-UTRA MBSFN measurements logging, the logged measurement report consists of MBSFN measurement results from target MBSFN area(s), if configured, and available downlink pilot strength measurement results. Inter-RAT downlink pilot strength measurements are not required to be logged.

For WLAN and Bluetooth measurement logging, the logged measurement reports consist of WLAN and Bluetooth measurement results, respectively.

The number of neighbouring cells to be logged is limited by a fixed upper limit per frequency for each category below. The UE should log the measurement results for the neighbouring cells, if available, up to:

- 6 for intra-frequency neighbouring cells;

- 3 for inter-frequency neighbouring cells per frequency;

- 3 for GERAN neighbouring cells per frequency;

- 3 for UTRAN (if non-serving) neighbouring cells per frequency;

- 3 for E-UTRAN (if non-serving) neighbouring cells per frequency;

- 3 for NR (if non-serving) neighbouring cells per frequency;

- 3 for CDMA2000 (if serving is E-UTRA) neighbouring cells per frequency;

- 32 for WLAN APs;

- 32 for Bluetooth Beacons.

NOTE: UE in NR IDLE or INACTIVE state will not log measurements from UMTS or GSM.

The measurement reports for neighbour cells consist of:

- Physical cell identity of the logged cell;

- Carrier frequency;

- RSRP and RSRQ for EUTRA and NR;

- RSCP and Ec/No for UTRA FDD,

- P-CCPCH RSCP for UTRA 1.28 Mcps TDD;

- Rxlev for GERAN;

- Pilot Pn Phase and Pilot Strength for CDMA2000;

- RSSI and RTT for WLAN APs;

- RSSI for Bluetooth Beacons.

For any logged cell (serving or neighbour), latest available measurement result made for cell reselection purposes is included in the log only if it has not already been reported.

While logging neighbour cells measurements, the UE shall determine a fixed number of best cells based on the measurement quantity used for ranking during cell reselection per frequency or RAT.

The MBSFN measurement results consist of, per MBSFN area where MBMS service is received:

- MBSFN area identity;

- Carrier frequency;

- MBSFN RSRP;

- MBSFN RSRQ;

- MCH BLER for signalling;

- MCH BLER for data, and related MCH index.

The WLAN measurement results consist of, per wireless network served by the WLAN AP:

- BSSID, SSID and HESSID;

- RSSI for WLAN;

- RTT.

The Bluetooth measurement results consist of, per wireless network served by the Bluetooth beacon:

- MAC address;

- RSSI for Bluetooth.

Measurements are performed in accordance with requirements defined in TS 25.133 [2] and TS 36.133 [3] and TS 38.133 [16].

The measurement report is self contained, i.e. the RAN node is able to interpret the Logged MDT reporting results even if it does not have access to the logged measurement configuration. Each measurement report also contains the necessary parameters for the network to be able to route the reports to the correct TCE and for OAM to identify what is reported. The parameters are sent to the UE in the logged configuration message, see clause 5.1.1.1.1.

For each MDT measurement the UE includes a relative time stamp. The base unit for time information in the Logged MDT reports is the second. In the log associated to periodical logging configuration, the time stamp indicates the point in time when periodic logging timer expires. The time stamp is counted in seconds from the moment the logged measurement configuration is received at the UE, relative to the absolute time stamp received within the configuration. The absolute time stamp is the current network time at the point when Logged MDT is configured to the UE. The UE echoes back this absolute reference time. The time format for Logged MDT report is: *YY-MM-DD HH:MM:SS*.

Location information is based on available location information in the UE. Thus, the Logged MDT measurements are tagged by the UE with location data in the following manner:

- ECGI, Cell-Id or NCGI in TS 38.300 [22] of the serving cell when the measurement was taken is always included in E-UTRAN, UTRAN or NR respectively;

- Detailed location information (e.g. GNSS location information) is included if available in the UE when the measurement was taken. If detailed location information is available, the reporting shall consist of latitude and longitude. Depending on availability, altitude, uncertainty and confidence may be also additionally included. UE tags available detailed location information only once with upcoming measurement sample, and then the detailed location information is discarded, i.e. the validity of detailed location information is implicitly assumed to be one logging interval;

- Sensor information (i.e. uncompensated barometric pressure measurement (for NR and E-UTRA), UE speed and UE orientation (only in NR)) can be included, if available in the UE when the measurement was taken.

NOTE: The neighbour cell measurement information that is provided by the UE may be used to determine the UE location (RF fingerprint).

Depending on location information availability, measurement log/report consists of:

- time information, RF measurements, RF fingerprints; or

- time information, RF measurements, detailed location information (e.g. GNSS location information);

 time information, RF measurements, detailed location information, sensor information.

/\*end of third change\*/

/\*start of fourth change\*/

### 5.1.4 UE capabilities

MDT relevant UE capabilities are component of radio access UE capabilities. Thus, the procedures used for handling UE radio capabilities over (E-)UTRAN and NR apply.

For (E-)UTRAN:

- The UE indicates one capability bit for support for Logged MDT, which indicates that the UE supports logging of downlink pilot strength measurements. The UE may also indicate capability for stand-alone GNSS positioning.

- The E-UTRA UE may indicate a capability for RX-TX time difference measurement for E-CID positioning for MDT.

- The E-UTRA UE may indicate a capability for support of logging of MBSFN measurements.

- The E-UTRA UE may indicate a capability for support of UL PDCP delay measurement when the UE is not configured with MR-DC.

- The E-UTRA UE may indicate a capability for support of UL PDCP Packet Average Delay measurement when the UE is configured with EN-DC.

- The E-UTRA UE may indicate a capability for support of Bluetooth measurements in RRC idle mode.

- The E-UTRA UE may indicate a capability for support of WLAN measurements in RRC idle mode.

- The E-UTRA UE may indicate a capability for support of Bluetooth measurements in RRC connected mode.

- The E-UTRA UE may indicate a capability for support of WLAN measurements in RRC connected mode.

- The E-UTRA UE may indicate capabilities for support of barometer measurements.

- For UMTS support of the Accessibility measurements is an optional UE feature.

For NR:

- The UE indicates one capability bit for support for Logged MDT in RRC idle and inactive mode, to indicate that the UE supports logging of downlink pilot strength measurements, periodical logging and event-triggered logging.

- The UE may indicate capability for stand-alone GNSS positioning.

- The NR UE may indicate a capability for support of UL PDCP packet average delay measurement.

- The NR UE may indicate a capability for support of Bluetooth measurements in RRC idle and inactive mode.

- The NR UE may indicate a capability for support of WLAN measurements in RRC idle and inactive mode.

- The NR UE may indicate a capability for support of Bluetooth measurements in RRC connected state.

- The NR UE may indicate a capability for support of WLAN measurements in RRC connected state.

- The NR UE may indicate a capability for support of barometer measurements.

- The NR UE may indicate a capability for support of orientation measurements.

- The NR UE may indicate a capability for support of speed measurements.

/\*end of fourth change\*/