**3GPP TSG-WG SA2 Meeting #152E e-meeting S2-22xxxxx**

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**Source: Huawei, HiSilicon**

**Title: KI#5: Update of evaluation and conclusion**

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*Abstract: Update of evaluation and conclusion for KI#5: Support of location services for UEs accessing via a mobile base station relay.*

# 1. Discussion

This contribution proposes to update the evaluation and conclusion for KI#5.

# 2. Text Proposal

It is proposed to capture the following changes into TR 23.700-05 V1.0.0.

\* \* \* \* First change \* \* \* \*

## 7.5 Evaluations for KI#5

For KI#5, the solution #7, #8, #14, #15, solution #18and solution #19are related and have the following common and different designs:

- Solution#7 (as updated at SA2#152) proposed that the LMF executes a TRP information procedure and gather information on which TRP is mobile when a MBSR is integrated in any RAN node (including at full migration time if applicable). this means that OAM ensures the LMF gathers the info it needs ahead of positioning procedure. then, when the LMF triggers a positioning event towards a RAN node, the LMF determines that one or more of the cells involved in UE positioning operation is a MBSR and the corresponding GPSI (with the serving cell ID) of the MBSR. The LMF uses the GPSI of the MBSR to identify the AMF serving the MBSR and trigger the positioning procedures for the MBSR via the AMF serving the MBSR. Alternately the LMF, for mobile TRP retrieves the TRP location information from the RAN of the MBSR(s)TRPs by causing the F1-AP to trigger a MO-LR procedure at MBSR IAB-UE (this can avoid contacting the UDM). The LMF uses this location together with the measurements data sets for the Target UE to estimate the location of the Target UE and provides the result to the Target UE’s serving AMF. The LMF may instruct the MBSR which the UE is accessing and other cells to start PRS broadcasting. The Target UE may be instructed to perform DL positioning measurements on the cells and report the measurements back to the LMF. The LMF derive from the measurements/cell-ID which measurement data set that belongs to a MBSR. The time of positioning measurements for UE and that for MBSR is different, so the accuracy of UE location estimation is affected. How to improve the accuracy is not described in this solution. In addition, the interaction between LMF and RAN via NRPPa message to trigger a MO-LR procedure at MBSR IAB-UE introduces additional latency.

- Solution#8 proposed that the MBSR provides its location to the LMF via NRPPa as part of the UL positioning procedure of the UE, and the MBSR may trigger MO-LR to obtain its own position for this purpose; and for DL positioning of the UE, since the LMF learns that the UE connects to MBSR, the LMF triggers the MBSR to provide its IAB-UE ID (e.g. GPSI) to LMF, which obtains the MBSR positioning and velocity information via MT-LR procedures. LMF perform calculation of UE location taking into account the MBSR location and velocity information. For the DL positioning of the UE, the IAB-UE ID (e.g. GPSI) is obtained by the LMF triggered by UE positioning, which introduces additional latency. When multiple UEs accessing the same MBSR need to perform DL positioning, the interaction between LMF and the MBSR via NRPPa message for the purpose of IAB-UE ID retrieval is very redundant. In addition, the AMF also provides LMF with a MBSR indication when the AMF determines that the UE connects to MBSR. During the UL positioning, the NRPPa message including the MBSR location is sent to LMF without the trigger from LMF. Therefore, the MBSR indication from AMF is not necessary for UL positioning.

- Solution#14 proposed that the PLMN level NRF stores the UE ID, cell ID, and the serving AMF of the MBSRs. The AMF serving the UE determines that a UE is accessing via MBSR when received additional ULI, and obtains the AMF information and IAB-UE ID of the MBSR (e.g. SUPI) from the PLMN level NRF. All the information needed for UE positioning can be determined by UE-AMF before LMF initiating a position procedure for a target UE as this is MBSR specific. The AMF provides the information to LMF, which triggers a positioning procedure for the MBSR. The LMF uses the location of the MBSR and the measurement data from the Target UE procedures to estimate the Target UE’s location. The two location measurements shall be done at the same time T. During the positioning procedure, this solution does not require any additional interaction between LMF and the RAN.

- Solution#15 proposed that the AMF serving the UE indicates to the LMF the existence of the MBSR. The LMF either obtains the MBSR position information when receiving the measurement reports from MBSR or by querying the MBSR with a specific time information. The interaction between LMF and RAN via NRPPa message to obtain MBSR location introduces additional latency. The MBSR velocity information is taken into consideration to determine the MBSR location at the requested time. The LMF requests the MBSR positioning information via NRPPa procedure similar to obtaining location information of a TRP.

- Solution #18 proposed that the NG-RAN keeps the 5G-GUTI of the MBSR, and provides that to the UE-AMF in the Initial UE message. All the information needed for UE positioning can be determined by UE-AMF before LMF initiating a position procedure for a target UE as this is MBSR specific. When location request is sent to the LMF, UE-AMF provides also the 5G-GUTI of MBSR, so that additional location procedure for MBSR can be triggered by the LMF. During the positioning procedure, this solution does not require any additional interaction between LMF and the RAN.

- Solution #19 proposed to several options to avoid sending privacy check signaling toward MBSR nodes, in order to optimize the network operations.

It is clear from the above that all solutions, assume that the AMF serving the UE would need to be informed of the existence of the MBSR. This can be achieved via either an explicit indication from NG-RAN, or the additional ULI information.

The LMF decides that the target UE connects to MBSR based on information received from the AMF. The AMF provides the information to LMF when it determines that the UE connects to MBSR based on the additional ULI received from NG-RAN as described in solution#7, #8 and #14. However, it is not described in solution#15 that how the AMF makes the decision. Furthermore, solution#15 also includes another way for LMF to make the decision, i.e. based on UE positioning capability which is enhanced to include MBSR access provided by UE via LPP. But it is also not described that how the UE determines that it connects to MBSR.

All solutions believe that the Target UE shall behave as a legacy UE and no new UE features are needed to support LCS for UEs accessing the network via a MBSR, e.g the Target UE reports the cell-ID in the DL positioning report to the LMF.

In most of the solutions, it is assumed that for the positioning procedure that involves MBSR measurements, the LMF obtains the MBSR location to calculate target UE location. How the LMF derives the location of the MBSR differs between the solutions. The LMF triggers the AMF that serves the MBSR directly (solution #7 and #14), or the LMF request the GMLC to derive the location (Solution #8). The GMLC will trigger the serving AMF in the next step. In both approaches the LMF needs to obtain the UE-ID of the MBSR. The third approach (in Solution #15) is that the LMF requests the location and velocity of the MBSR by using modified NRPPa procedure.

For Solution#15, the MBSR location is obtained by the UE’s LMF using NRPPa query for TRP location, and no UE ID for MBSR is needed.

How the LMF resolves the cell-ID may differ slightly between the solutions. In Sol#7 The LMF correlates cell-ID with GPSI of MBSR received by the AMF and/or in TRP information exchanges . In addition, after the LMF learns that a cell is mobile during TRP Information Exchange procedure, the LMF triggers to subscribe the latest Cell ID of MBSR so that the latest Cell ID of MBSR can be reported to the LMF upon the Cell ID of the MBSR. In Sol#8 the IAB-donor RAN node provides the GPSI to the LMF. In Sol#14 the AMF-UE queries the PLMN level NRF for the MBSR’s SUPI and AMF-ID of the AMF that is serving the MBSR using the cell-ID. The AMF provides this info to the LMF. In Sol#15 the LMF receives the cell-ID with an indication that it is a MBSR from the AMF.

As indicated in both solution#8 and solution#15, the time of positioning measurements for UE and that for MBSR could be different. In order to reduce positioning error caused by the time difference, it is useful to take MBSR velocity into consideration. This is also applicable to other solutions. Solution#14 and solution#7 also touches on ensuring the positioning information to be measured at the same time or as close as possible.

\* \* \* \* Second change \* \* \* \*

## 8.5 Conclusions for KI#5

The following legacy behaviours are applied to KI#5:

- Target UE performs location measurements and SRS transmission as a legacy Rel-17 UE.

- The Target UE reports the cell-IDs of all the TRP/gNB/eNB the UE performed DL positioning measurements on.

- The MBSR includes its cell-ID in the reported UL positioning measurement that it performed on the Target UE.and ’ of MBSR.

For Key Issue #5 (Support of location services for UEs accessing via a mobile base station relay), the followings are taken as initial conclusion:

- The AMF serving UE provides the cell-ID of the cell that the Target UE is connected to the LMF in the location request (legacy behaviour) and indicates if possible that the cell-ID belongs to a MBSR. The AMF serving UE also provides LMF with the IAB-UE ID of the MBSR so that the LMF initiates the positioning procedure for MBSR.

Editor's note: How the AMF serving UE obtains the IAB-UE ID of the MBSR will be discussed in the normative phase.

Editor's note: It is FFS whether the AMF provides more parameters related to the MBSR to the LMF.

- The LMF uses the Target UE reported cell-IDs to derive whether the cell-ID corresponds to a MBSR. There can be more than one MBSR in the measurement report.

- Options for the LMF to derive the location the MBSR.

- The LMF can derive the location of the MBSR by either triggering the AMF serving the MBSR, or the gNB serving the MBSR (as per solution#7 MO-LR case) or by requesting the GMLC to derive the location of the MBSR (UE).

- When the LMF of the UE needs to obtain the MBSR location information, it can use NRPPa procedure for TRP location query that triggers the MBSR to perform MO-LR;

Editor's note: It is FFS whether the NRPPa procedure for TRP location needs to be enhanced to include velocity estimation.

- When MBSR is involved in providing the positioning measurements for the UE (and the LMF knows it from info obtained e.g. from TRP info exchanges), the MBSR location information may be provided by the MBSR via NG-RAN to the LMF via NRPPa;

Editor's note: It is FFS whether all these options for LMF to derive the location of MBSR would be supported.

- As the timing of the location estimations for the Target UE and MBSR(s) is important for the quality of the location estimation of the Target UE, the mechanism to ensure the positioning information to be measured at the same time should be specified .

\* \* \* \* End of changes \* \* \* \*