**3GPP T****SG-RAN WG2 Meeting #115-e draft-R2-2108898**

**E-Meeting: August 09-27, 2021**

**Agenda item: 8.10.3.1**

**Source: Qualcomm Incorporated**

**Title: [offline 102] LCS aspects - second round**

**Document for: Discussion and Decision**

# Introduction

Followings are agreements made in RAN2#115e regarding UE location information report.

Agreements:

1. If SA3 replies with concern on reporting UE location with any granularity during initial access, RAN2 will revisit agreement/solution for reporting UE location during initial access.
2. UE coarse location information refers to coarse GNSS coordinates (FFS on the details, e.g. X MSB bits out of 24 bits of longitude/latitude or GNSS coordinates with ~2km accuracy). FFS if any enhancements to validate the UE’s coarse location information is needed. FFS whether this is only used in initial access or also in connected

Agreements via email - via offline 102:

1. If SA3 has no concern reporting coarse location during initial access, the coarse location information is reported in Msg5, i.e., via RRCSetupComplete/RRCResumeComplete message.
2. For coarse UE location reporting during initial access, the location granularity is not indicated to UE via SIB
3. Enhancements to validate the UE ’s coarse location information is not needed from RAN2 perspective. Whether this is needed by the network is up to other WGs.
4. After AS security is established, gNB can obtain a GNSS-based location information from the UE using existing signalling method, i.e., by configuring includeCommonLocationInfo in the corresponding reportConfig. It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN. RAN2 discuss whether to send LS to SA3
5. Aperiodic location reporting (e.g., via DCI) is not supported.

Working assumption:

1. Event triggered-based UE location reporting are configured by gNB to obtain UE location update of mobile UEs in RRC\_CONNECTED

 This document provides report of the following second round offline discussion.

**[AT115-e][102][NTN] LCS aspects (Qualcomm)**

Updated scope: Continue the discussion on remaining proposals from [R2-2108884](file:///C%3A%5CData%5C3GPP%5CRAN2%5CInbox%5CR2-2108884.zip) and draft reply LS responses to RAN3 (contact Qualcomm) and SA3 (contact Huawei)

Intended outcome: Summary of the offline discussion with e.g.:

  List of proposals for agreement (if any)

  List of proposals for further discussion

  List of proposals that should not be pursued (if any)

Updated deadline (for companies' feedback): Monday 2021-08-23 1600 UTC

Updated deadline (for rapporteur's summary in R2-2108898 and reply LSs to RAN3 and SA3): Monday 2021-08-23 2000 UTC

Proposals marked "for agreement" in R2-2108898 not challenged until Tuesday 2021-08-24 0800 UTC will be declared as agreed via email by the session chair (for the rest the discussion will continue online during the CB session).

Status: Ongoing

# Discussion

## Remaining proposals from R2-2108884

Summary of phase-1 from R2-2108884 [4]:

# support of coarse UE location report in RRC\_CONNECTED is 11/27.

# support of finer UE location report in RRC\_CONNECTED is 20/27.

Agreement:

1. UE coarse location information refers to coarse GNSS coordinates (FFS on the details, e.g. X MSB bits out of 24 bits of longitude/latitude or GNSS coordinates with ~2km accuracy).
2. After AS security is established, gNB can obtain a GNSS-based location information from the UE using existing signalling method, i.e., by configuring includeCommonLocationInfo in the corresponding reportConfig. It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN. RAN2 discuss whether to send LS to SA3

Following is agreement from offline [103].

Working Assumptions:

1. Specify that measurement reports can be configured to be piggybacked with location report when location based event triggers it

Rapporteur thinks existing signaling in RRC\_CONNECTED can be used to carry both fine and coarse location information with some impact to TS 37.355 and TS 23.032 for coarse location information. For example, in TS 38.331

1> if the *includeCommonLocationInfo* is configured in the corresponding *reportConfig* for this *measId* and detailed location information that has not been reported is available, set the content of *commonLocationInfo* of the *locationInfo* as follows:

2> include the *locationTimestamp*;

2> include the *locationCoordinate*, if available;

2> include the *velocityEstimate*, if available;

2> include the *locationError*, if available;

2> include the *locationSource*, if available;

2> if available, include the *gnss-TOD-msec*,

CommonLocationInfo-r16 ::= SEQUENCE {

 gnss-TOD-msec-r16 OCTET STRING OPTIONAL,

 locationTimestamp-r16 OCTET STRING OPTIONAL,

 locationCoordinate-r16 OCTET STRING OPTIONAL,

 locationError-r16 OCTET STRING OPTIONAL,

 locationSource-r16 OCTET STRING OPTIONAL,

 velocityEstimate-r16 OCTET STRING OPTIONAL

}

|  |
| --- |
| ***CommonLocationInfo* field descriptions** |
| 1. ***gnss-TOD-msec***
2. Parameter type *gnss-TOD-msec* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
 |
| 1. ***locationTimeStamp***
2. Parameter type *DisplacementTimeStamp* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
 |
| 1. ***locationCoordinate***
2. Parameter type *LocationCoordinates* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
 |
| 1. ***locationError***
2. Parameter *LocationError* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
 |
| 1. ***locationSource***
2. Parameter *LocationSource* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
 |
| 1. ***velocityEstimate***
2. Parameter type *Velocity* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
 |

In TS 37.355, the parameter type *LocationCoordinates* is defined as CHOICE as follows

LocationCoordinates ::= CHOICE {

 ellipsoidPoint Ellipsoid-Point,

 ellipsoidPointWithUncertaintyCircle Ellipsoid-PointWithUncertaintyCircle,

 ellipsoidPointWithUncertaintyEllipse EllipsoidPointWithUncertaintyEllipse,

 polygon Polygon,

 ellipsoidPointWithAltitude EllipsoidPointWithAltitude,

 ellipsoidPointWithAltitudeAndUncertaintyEllipsoid

 EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

 ellipsoidArc EllipsoidArc,

 ...,

 highAccuracyEllipsoidPointWithUncertaintyEllipse-v1510

 HighAccuracyEllipsoidPointWithUncertaintyEllipse-r15,

 highAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-v1510

 HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15

}

For coarse UE location reporting, a new IE coarseellipsoidPoint can be added to TS 37.355 as

LocationCoordinates ::= CHOICE {

 ellipsoidPoint Ellipsoid-Point,

 ellipsoidPointWithUncertaintyCircle Ellipsoid-PointWithUncertaintyCircle,

 ellipsoidPointWithUncertaintyEllipse EllipsoidPointWithUncertaintyEllipse,

 polygon Polygon,

 ellipsoidPointWithAltitude EllipsoidPointWithAltitude,

 ellipsoidPointWithAltitudeAndUncertaintyEllipsoid

 EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

 ellipsoidArc EllipsoidArc,

 ...,

 highAccuracyEllipsoidPointWithUncertaintyEllipse-v1510

 HighAccuracyEllipsoidPointWithUncertaintyEllipse-r15,

 highAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-v1510

 HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15,

 coarseellipsoidPoint Coarse-Ellipsoid-Point

}

#### *– Ellipsoid-Point*

The IE *Ellipsoid-Point* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

Ellipsoid-Point ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

 degreesLatitude INTEGER (0..8388607), -- 23 bit field

 degreesLongitude INTEGER (-8388608..8388607) -- 24 bit field

}

-- ASN1STOP

#### *x– Coarse-Ellipsoid-Point*

The IE *Coarse-Ellipsoid-Point* is used to describe a geographic shape with 2km radius circular uncertainty as defined in TS 23.032 [15].

-- ASN1START

Coarse-Ellipsoid-Point ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

 degreesLatitude INTEGER (0..8191), -- 13 bit field

 degreesLongitude INTEGER (-8192..8291) -- 14 bit field

}

-- ASN1STOP

#### *– Ellipsoid-PointWithUncertaintyCircle*

The IE *Ellipsoid-PointWithUncertaintyCircle* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

Ellipsoid-PointWithUncertaintyCircle ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

 degreesLatitude INTEGER (0..8388607), -- 23 bit field

 degreesLongitude INTEGER (-8388608..8388607), -- 24 bit field

 uncertainty INTEGER (0..127)

}

-- ASN1STOP

1. Reporting of finer location information/full GNSS coordinates in RRC\_CONNECTED is supported after AS security is enabled [20/27].
2. Coarse UE location report is also supported after AS security is enabled [11/27].

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Proposal 1(Agree/Not agree) | Proposal 2(Agree/Not agree) | Comments  |
| CATT | Agree | Agree | Finer UE location is good for other purposes besides CGI mapping. But finer location information which is finer than 2KM should be confirmed with SA3 if there is such finer UE location info is agreed in RAN2. Usually gNB is not permitted to obtain finer UE location except SON/MDT where User Consent is required. |
| MediaTek | Not Agree | Agree | Following the current specs seem enough for Rel-17. Any enhancements to positioning accuracy can be pursued in the future releases. Evaluation of accuracy better than 2km needs to be evaluated first. |
| Lenovo | Agree but | Not agree | Considering that gNB can obtain a GNSS-based location information from the UE using existing signalling method, there is no need to define new message or mechanism for the same or coarse information. We agree to Proposal 1 if it refers to using existing signalling method. |
| OPPO | Agree but | Not agree | Proposal 1 can be agreed after the need of User Consent is clarified.For coarse location report, we don’t see the need if finer location report is supported. |
| Apple | Disagree | Disagree | Without user consent there is no discussion of finer location. We don’t see the need for coarse location in RRC\_CONNECTED state. |
| vivo | Agree | Not agree | We don’t think something new like “coarse UE location” needs to be introduced in RRC CONNECTD mode, with the full location info already supported in the Spec. Also, it should be noted that although the *locationInfo* was introduced under the umbrella of SON/MDT, it does not necessarily mean that the definition of the signalling/IE can only be used for SON/MDT, and it can be used for other purpose. As an example, in LTE we also had this *locationInfo* reporting, and it was extended to support a purpose specific to LTE V2V SL in Rel-14 (i.e. *purpose* of *reportLocation* for periodical reporting). |

Agreement

1. After AS security is established, gNB can obtain a GNSS-based location information from the UE using existing signalling method, i.e., by configuring includeCommonLocationInfo in the corresponding reportConfig. It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN. RAN2 discuss whether to send LS to SA3
2. Send LS to SA3 for the need of NTN specific user consent for obtaining UE location by gNB [3/27].

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| --- | --- | --- |
| Company | Proposal 3(Agree/Not agree) | Comments  |
| CATT | Agree with comments | And RAN2 should specify how finer the UE location is or the accuracy of the location in this LS. |
| MediaTek | Not Agree | Finer location information reporting is not needed at this point. |
| Lenovo | Not Agree | The existing mechanism (e.g. MDT based on User Consent) can be reused. There is no need to introduce new mechanism and ask SA3. |
| OPPO | Agree with comments | About user consent, not sure if SA5 should also be involved. |
| Apple | Agree | We agree with oppo that SA5 might also need to be involved along with SA3.  |
| vivo | Agree | We can accept to check with SA3 if the majority wants to. |
| Huawei, HiSilicon | Agree | We can ask if user consent for MDT can be reused for NTN. |

Summary of phase-1 from R2-2108884 [4]:

Support of periodic location reporting: 20/27

Support of event triggered based location reporting: 23/27

Support of aperiodic location reporting: 3/27

Agreement:

1. Aperiodic location reporting (e.g., via DCI) is not supported.

Working assumption:

1. Event triggered-based UE location reporting are configured by Gnb to obtain UE location update of mobile Ues in RRC\_CONNECTED
2. Periodic location reporting [20/27] can also be configured by Gnb to obtain UE location update of mobile Ues in RRC\_CONNECTED.

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| --- | --- | --- |
| Company | Proposal 4(Agree/Not agree) | Comments  |
| CATT | Agree | Periodic UE location report works for CGI mapping by saving signalling. |
| MediaTek | Not Agree | Only event triggered reporting seems enough. |
| Lenovo | Yes but | The existing mechanism (e.g. MDT based on User Consent) can be reused. There is no need to introduce new mechanism. |
| OPPO | Agree  | Taking the framework of measurement report as baseline, periodic location reporting can be supported. |
| Apple | Disagree | We don’t agree to this unless the user consent for NTN is explicitly agreed. Also this should be an optional feature from our view and should be discussed in that context.  |
| vivo | Agree | We can accept this if the majority wants it. |

Agreement:

1. Aperiodic location reporting (e.g., via DCI) is not supported.

Working assumption:

1. Event triggered-based UE location reporting are configured by gNB to obtain UE location update of mobile UEs in RRC\_CONNECTED
2. The event triggered-based condition to trigger UE location report is

Oprion#1: Change in UE location by a distance threshold since the last reported UE location.

Option#2: UE moves by a distance threshold from a cell reference location.

Option#3: others (please elaborate in comments).

Option#4: wait until working assumption is confirmed.

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| --- | --- | --- |
| Company | Which option | Comments  |
| CATT | Option1 and 2 | Option 1 and 2 can be configured separately or together. |
| MediaTek | Option 1 and 2 |  |
| Lenovo | Option 3 | The existing events used in MDT based on User Consent. There is no need to introduce new event. |
| OPPO | Option 2 | Option 2 works for both earth-moving and earth-fixed cell scenarios. |
| Apple | Option 4 |  |
| vivo | Option 4 | We think the WA should be first confirmed before moving forward. Also, we think it is worth looking into the specific triggers in detail in future meetings, instead of making a decision with the quite limited time remaining in this meeting on the fly. |
| Huawei, HiSilicon | Option 4 |  |

## Draft reply LS responses to RAN3

The draft LS in response to RAN3 LS is provided in R2-2107568 [2]. It is given below for your convenience.

**Question 1: RAN3 would like RAN2 to confirm whether the Gnb will be able to acquire UE location information with an accuracy comparable to TN cell granularity (e.g. GNSS information** **or otherwise) after AS security, and also to confirm whether it is possible to provide any level of UE location information (i.e. finer than NTN Uu cell accuracy) before AS security.**

**RAN2 answer:** RAN2 has made following agreements:

* UE coarse location information refers to coarse GNSS coordinates (FFS on the details, e.g. X MSB bits out of 24 bits of longitude/latitude or GNSS coordinates with ~2km accuracy).
* if SA3 has no concern reporting coarse location during initial access, the coarse location information is reported in Msg5, i.e., via *RRCSetupComplete*/*RRCResumeComplete* message.
* After AS security is established, Gnb can obtain a GNSS-based location information from the UE using existing signalling method, i.e., by configuring *includeCommonLocationInfo* in the corresponding r*eportConfig*. It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN.
1. Do you agree with the answer to Question 1? Please provide any suggestion in comments.

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| --- | --- | --- |
| Company | Proposal 6(Yes/No) | Comments  |
| CATT | Yes with comments | The accuracy/uncertainty of GNSS-based location information after security also should be confirmed with SA3 in the LS.  |
| MediaTek | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes with comments | We think SA5 should be included, i.e. SA3/SA5. |
| Apple | Yes with comments  | Besides confirming this with SA3, RAN2 should only answer if we can do in the granularity of TN or not. We do not understand the 2km requirement artificially put in by RAN2. We see that the coarse location discussion is coming into picture due to this. Also prefer the wording “If available, UE coarse location information refers ….. “ |
| vivo | Yes with comments | Besides above information to SA3, it is better for us to directly ask for SA3’s feedback on the pending points, e.g. “if SA3 has no concern reporting coarse location during initial access” and “It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN”. |

**Question 3: RAN3 welcomes any feedback from RAN2 on the described case (i.e. the Gnb to trigger inter-AMF handover when crossing country borders).**

**RAN2 answer:** RAN2 understands it is up to the Gnb how it decides to trigger inter-AMF handover using any available information such as UE location information reported by UE.

1. Do you agree with the answer to Question 3? Please provide any suggestion in comments.

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| --- | --- | --- |
| Company | Proposal 7(Yes/No) | Comments  |
| CATT | Yes | It’s up to RAN3 make a decision based on the agreement of obtaining UE’s location from RAN2. |
| MediaTek | Yes | It is entirely up to RAN3 |
| Lenovo | Yes | Up to RAN3. |
| OPPO | Yes |  |
| Apple | Yes | We prefer the statement .. “RAN2 understands it is up to the Gnb how it decides to trigger inter-AMF handover using any available information such as UE location information, if available and reported by UE.” |
| vivo | No | We think that if companies think it is eventually up to RAN3 to decide, we can directly inform them of this RAN2 understanding, not necessarily having to give understating from a RAN2 perspective.  |
|  |  |  |

**Question 4: RAN3 requests RAN2, CT1 and SA2 to provide any feedback on above issue (i.e. which TAC should be reported by the Gnb in case of multiple broadcast TAC).**

**RAN2 answer:** RAN2 understands it is up to the other working groups whether to use UE location information, if reported by UE, to determine TAC for the UE.

1. Do you agree with the answer to Question 4? Please provide any suggestion in comments.

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| --- | --- | --- |
| Company | Proposal 8(Yes/No) | Comments  |
| CATT | partially | UE doesn’t always report location. Perhaps the TAC may be changed after the last reported UE location according to the event-trigger condition. So it is not accurate in the answer that UE location reported by UE can determine TAC for the UE.Prefer to update as: RAN2 understands it is up to the other working groups to determine TAC for the UE.Or agree that Gnb can report possible multi TACs. |
| MediaTek | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Apple | Yes but  | We prefer the wording “RAN2 understands it is up to the other working groups whether to use UE location information, if available and reported by UE, to determine TAC for the UE.” |
| vivo | No | The situation in Ph-1 discussion is that the majority wanted to depend on the outcome of Offline-107, and would like to see the possibility that the UE itself decides a firm TAI and directly report the corresponding TAC to the NW. The final decision on how the firm TAC is decided should be up to CT1/SA2 decision, based on which RAN2 can further discuss whether it is feasible to report TAC directly to the RAN. Now that we need to await CT1/SA2’s final decision on the TAI selection, we may inform RAN3 that “some companies think to use UE location information to determine TAC by the RAN for the UE is possible. There is another possibility that the UE can decide a firm TAC and report it directly to the RAN, but this possibility is up to the final confirmation of CT1/SA2. RAN2 is under the discussion of this issue, and will keep RAN3 informed by the latest progress”.  |

## Draft reply LS responses to SA3

RAN2 also received LS from SA3 and draft LS is provided in R2-2107346 [3]. It is given below for your convenience.

**Question 1: What is the purpose of sending A-GNSS based measurements after AS security has been established? Is it for core network reselection after initial core network selection?**

RAN2 answer: RAN2 believes that this is for potential core network reselection after initial core network selection. After AS security has been established, LCS procedure via LMF can be initiated to verify UE’s location and check whether UE has selected a PLMN that is allowed to operate in the country of the UE location.

**Question 2: Are the A-GNSS based measurements used by the applied UE positioning method during LCS procedure or used in a different procedure?**

RAN2 answer: RAN2 believes that A-GNSS based measurements are parts of A-GNSS positioning method, and it is during LCS procedure.

Summary of phase-1 from R2-2108884 [4]:

One company think SA2 can answer to question 1. One company asks “Is RAN2 in the position to inform SA3 on how the UE location reporting is used for core network selection?”. One company suggests editorial correction for the answer to question 2. Others fine with the draft LS in R2-2107346 [3].

1. Agree to draft LS reply to SA3 provided in R2-2107346 [3] with minor necessary change.

|  |  |  |
| --- | --- | --- |
| Company | Proposal 9(Agree/Not agree) | Comments  |
| CATT | Agree |  |
| MediaTek | Agree |  |
| Lenovo | Agree |  |
| OPPO | Agree |  |
| Apple | Agree |  |
| vivo | Agree |  |
| Huawei, HiSilicon | Agree | We think the minor changes are:1. Remove the “Draft” in title;2. Change source to “RAN2”. |

# Conclusion

To be updated…

# references

[1] R2-2108848, “[Pre115-e][102][NTN] Summary of AI 8.10.3.1 - LCS aspects only”, Qualcomm Incorporated.

[2] R2-2107568, “[Draft] Reply LS on UE location aspects in NTN”, Qualcomm Incorporated.

[3] R2-2107346, “Draft Reply LS on UE location aspects in NTN”, Huawei, HiSilicon.

[4] R2-2108884, “[offline 102] LCS aspects”, Qualcomm Incorporated.